Discoveries in Frontloading Home Physical Therapy Visits for Patients with Heart Failure

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Chair, Department of Physical Therapy, Plymouth State University

Heart Failure – A Growing Problem in the United States

- 5.7 million individuals in US have HF.
- Advances in telemedicine, pharmacotherapy, and ventricular assistive devices have increased survival rates in HF.

Heart failure: Hospital Admissions and Readmissions

- HF- The most frequent diagnosis for hospital admissions and readmissions.
  - Minino et al. Centers for Disease Control and Prevention; 2011
- 25% of patients with HF readmitted within 30 days.
  - Desai and Stevenson, Circulation; 2012
- 83% of patients with HF admitted once, 43% admitted at least 4 times per year.
Post Discharge Environment and Readmissions

- Evidence suggests that many hospital readmissions are not explained by underlying disease but are related to low functional status and reduced physiological capacity.
- An unmet need for functional disabilities increases the risk for future hospital admissions.
- AHA strongly believes that it is important to consider post discharge environment and functional capacity as critical components in addressing readmissions.
  - Hersh et al., Journal of the American Heart Association, 2013

6MWD and Readmission

- 6MWD of less than 400 meters revealed significantly greater readmission rates compared to patients with HF and higher 6MWD scores.

Kommuri N, Johnson M, Koelling T. Six minute walk predicts 30-day readmission in hospitalized heart failure patients. Archives of Med Res. 2010; 41:363-68

Frontloading of Home Visits

- Frontloading protocol: Involves delivery of higher frequency (60%) of planned visits in the first 2 weeks of home care and tapered frequency toward the end of care.
- Evidence on reduced readmissions with frontloading.
- No evidence on frontloading in PT
Problem

Given:
- Growing prevalence of HF in the US.
- Readmissions: A major issue in HF.
- Frontloading effective in nursing care

However:
- No research exists on the effects of home PT.
- No evidence on the appropriate dosage of PT visits in home care.
- No evidence examining frontloading of home PT visits on function and readmissions.

Therefore…

Purpose

The primary purpose was to evaluate the effects of a frontloading protocol of home PT treatment visits on:

1. Functional outcome measurements including:
   - Gait Speed (GS)
   - Timed Up and Go Test (TUG)
   - 30 Second Chair Rise (30CRT)
   - 2 Minute Step Test (2 MST)
   - 2 Minute Walk Test (2MWT)

2. Quality of life measured by the Minnesota Living with Heart Failure Questionnaire and,

3. 30 day hospital readmissions rates for patients with HF.

Research Questions

1. Does a frontloading protocol of home health PT treatment visits significantly improve the Functional Outcome indices of the patients compared to a control group receiving a traditional protocol of visit frequency?
2. Does a frontloading protocol of home health PT treatment visits significantly improve Quality of life (QOL) indices as measured by the Minnesota Living with Heart Failure Questionnaire (MLHFQ) compared to a control group receiving a traditional protocol of visit frequency?
3. Does a frontloading protocol of home health PT treatment visits significantly improve 30 day hospital readmission compared to a control group receiving a traditional protocol of visit frequency?
7 Directional Hypotheses

Frontloading of visits will significantly:
1. Improve GS scores
2. Improve TUG test scores
3. Improve 30-CRT scores
4. Improve 2MWT scores
5. Improve 2MST scores
6. Improve QOL with lower MLHFQ scores
7. Improve 30-day readmission rates

Funding

- Home Health Section of the American Physical Therapy Association
- Cardiovascular and Pulmonary Section of the American Physical Therapy Association
- Earl and Myrtle Walker College of Health Professions at Maryville University

Methodology – Study Design

- Multi site, Prospective, Randomized Controlled, Single Blinded Design
  - Three home health agencies in the continental US
  - Randomization using a Research Randomizer web based software.
  - Concealed allocation: Sealed envelopes on website http://ilp.maryville.edu/dev/dias/valley/
  - Data Collectors were blinded to group allocation.
3 Research Centers

- Valley Home Health, Winchester, Virginia.
- St. Elizabeth Home Health, Florence, Kentucky
- Choice Home Care, Tyler, Texas

Institutional Board Approvals

- Nova Southeastern University Institutional Review Board
- Maryville University Institutional Review Board
- Winchester Medical Center Institutional Review Board

Entities at each research center

- HHA Physical Therapists/Physical Therapists Assistants
  - Subject recruitment
  - Complete demographic sheet
  - Provide care for 30 days
- Research Coordinator
  - Coordination of care
- Data Collectors
  - Collect data
SUBJECTS
- **Inclusion Criteria:**
  - Primary discharge diagnosis of heart failure or have been admitted with a sign or symptom associated with heart failure in the PMH.
  - Formal PT referral from a physician.
  - Discharged from hospital directly to home health.
  - Ambulatory in the house with or without the use of an assistive device.
  - Timed Up and Go Test with no more assist than guarding and cues.
  - Follow basic commands.
  - 65 years of age or older.
  - Homebound and qualify for home PT services.
  - Willing to participate in up to 5 days of PT per week.
- **Exclusion Criteria:**
  - VAD, Continuous inotropic support, NYHA Classification IV, decompensated HF, moderate to severe aortic stenosis, life threatening arrhythmias.

GROUP ASSIGNMENT
- **Front-loaded or Experimental Group:**
  - 5 treatment visits per week for 2 weeks
  - 3 treatment visits per week for 2 weeks
- **Control Group:**
  - 2 treatment visits per week for 4 weeks

<table>
<thead>
<tr>
<th>Week Number</th>
<th># Visits in Experiment Group</th>
<th># Visits in Control Group</th>
<th>Percent Difference between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>2</td>
<td>60%</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>2</td>
<td>60%</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>16</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Data Collection
- Data collected at three distinct points in time:
  - Measured at baseline, 2 weeks and 4 weeks.
- Designated data collectors blinded to the subject’s group allocation.
- Functional Outcome Measures (conducted in following order):
  - Gait Speed (GS)
  - Timed Up and Go Test (TUG)
  - 30 Second Chair Rise (30CRT)
  - 2 Minute Step Test (2 MST)
  - 2 Minute Walk Test (2MWT)
- Minnesota Living with Heart Failure (baseline and discharge)
- 30 day Readmission: measured at 30 days post hospital discharge.
## Data Analysis

- **IBM SPSS Version 23**
- **Descriptive statistics**
  - Demographic data and outcome measures
- **T-tests:** Groups equal at baseline
- **Repeated measures ANOVA**
  - Group differences over time.
  - Effects reported as significant if p < 0.05
- **Cross-tabulation tables:** Summarize readmissions
- **Chi square tests:** Differences in readmissions
- **Spearman’s rho correlation:** assess for factors that are significantly correlated to readmission

## RESULTS: Participants

<table>
<thead>
<tr>
<th>Total Number of Subjects Recruited: 88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental: 43</td>
</tr>
<tr>
<td>Control: 39</td>
</tr>
<tr>
<td>Males: 43</td>
</tr>
<tr>
<td>Females: 44</td>
</tr>
<tr>
<td>Males: 19</td>
</tr>
<tr>
<td>Females: 24</td>
</tr>
</tbody>
</table>

- **Total Number of Subjects Completed Study: 82**
- **Dropped out of Study:** 4
- **Deceased:** 2
### Demographic Data N = 82

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental (n=43)</th>
<th>Control (n=39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>76 (10.58)</td>
<td>78 (9.8)</td>
</tr>
<tr>
<td>Height (meters)</td>
<td>1.67 (0.13)</td>
<td>1.68 (0.10)</td>
</tr>
<tr>
<td>Weight (kilograms)</td>
<td>81 (20)</td>
<td>84 (24)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.3 (7.6)</td>
<td>30.1 (9.7)</td>
</tr>
<tr>
<td>EF (%)</td>
<td>48 (15)</td>
<td>48 (14)</td>
</tr>
<tr>
<td>BUN (mg/dL)</td>
<td>34 (20)</td>
<td>26 (13)</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>1.5 (0.8)</td>
<td>1.5 (0.8)</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>12 (2.1)</td>
<td>11 (2.8)</td>
</tr>
<tr>
<td>BNP (pg/mL)</td>
<td>1379 (1508)</td>
<td>811 (916)</td>
</tr>
<tr>
<td>Years with HF (years)*</td>
<td>4.3 (1.1)</td>
<td>6.5 (4.4)</td>
</tr>
</tbody>
</table>

### Number of Comorbidities

<table>
<thead>
<tr>
<th>Number of Comorbidities</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>2</td>
<td>18%</td>
<td>28%</td>
</tr>
<tr>
<td>3</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>4</td>
<td>33%</td>
<td>31%</td>
</tr>
<tr>
<td>5</td>
<td>23%</td>
<td>13%</td>
</tr>
<tr>
<td>6</td>
<td>5%</td>
<td>3%</td>
</tr>
</tbody>
</table>

### Number of Cardiac Medications

<table>
<thead>
<tr>
<th>Number of Cardiac Medications</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20%</td>
<td>7.5%</td>
</tr>
<tr>
<td>2</td>
<td>34%</td>
<td>41%</td>
</tr>
<tr>
<td>3</td>
<td>25%</td>
<td>44%</td>
</tr>
<tr>
<td>4</td>
<td>17%</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

### Understanding Within Subjects, Between Subjects and Interaction Effects

- **Significant Within Group, No Between Group, No Interaction Effect**
- **Significant Within Group, No Between Group, Interaction Effect**
- **Significant Within Group, Sig. Between Group and Interaction Effect**
- **Significant Within Group, Sig. Between Group, No Interaction Effect**
Baseline Mean Scores

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline Mean Score</th>
<th>Baseline Stand. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS: Exper. Group</td>
<td>0.48 meters/sec</td>
<td>0.24 meters/sec</td>
</tr>
<tr>
<td>GS: Control Group</td>
<td>0.52 meters/sec</td>
<td>0.22 meters/sec</td>
</tr>
<tr>
<td>TUG: Exper. Group</td>
<td>28.8 seconds</td>
<td>24.0 seconds</td>
</tr>
<tr>
<td>TUG: Control Group</td>
<td>21.3 seconds</td>
<td>11.2 seconds</td>
</tr>
<tr>
<td>30-CRT: Exper. Group</td>
<td>3.46 rises</td>
<td>3.31 rises</td>
</tr>
<tr>
<td>30-CRT: Control Group</td>
<td>5.28 rises</td>
<td>4.02 rises</td>
</tr>
<tr>
<td>2MST: Exper. Group</td>
<td>32.96 steps</td>
<td>19.44 steps</td>
</tr>
<tr>
<td>2MST: Control Group</td>
<td>44.03 steps</td>
<td>29.17 steps</td>
</tr>
<tr>
<td>2MWT: Exper. Group</td>
<td>136.52 feet</td>
<td>69.52 feet</td>
</tr>
<tr>
<td>2MWT: Control Group</td>
<td>149.75 feet</td>
<td>87.96 feet</td>
</tr>
<tr>
<td>QOL: Exper. Group</td>
<td>59.14 points</td>
<td>25.36 points</td>
</tr>
<tr>
<td>QOL: Control Group</td>
<td>65.88 points</td>
<td>22.07 points</td>
</tr>
</tbody>
</table>

Gait Speed

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.60</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.72</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Timed Up and Go Test

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.13</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>&lt; 0.00</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.18</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>&lt; 0.02</td>
</tr>
</tbody>
</table>
### 30 second Chair Rise Test

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.07</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>0.00</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.04</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>0.84</td>
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</tbody>
</table>

### 2 Minute Step Test

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.10</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>0.05</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.21</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>0.41</td>
</tr>
</tbody>
</table>

### 2 Minute Walk Test

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.55</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>0.00</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.81</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>0.33</td>
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</tbody>
</table>
Quality of Life

<table>
<thead>
<tr>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Difference</td>
<td>0.31</td>
</tr>
<tr>
<td>Within Subjects Effect</td>
<td>0.00</td>
</tr>
<tr>
<td>Between Subjects Effect</td>
<td>0.02</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Differences in 30 Day Readmission

<table>
<thead>
<tr>
<th>Group</th>
<th>Total</th>
<th>Not Readmitted</th>
<th>Readmitted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>31</td>
<td>12 (28%)</td>
<td>8 (21%)</td>
<td>20 (25%)</td>
</tr>
<tr>
<td>Control</td>
<td>31</td>
<td>20</td>
<td>8 (21%)</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>32 (25%)</td>
<td>20 (25%)</td>
<td>82</td>
</tr>
</tbody>
</table>

Chi Square Analysis p=0.455

Analysis of Factors Affecting Readmission

<table>
<thead>
<tr>
<th>Factor</th>
<th>Spearman Correlation R</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.046</td>
<td>.695</td>
</tr>
<tr>
<td>Gender</td>
<td>.077</td>
<td>.511</td>
</tr>
<tr>
<td>Years HF</td>
<td>.042</td>
<td>.719</td>
</tr>
<tr>
<td>BMI</td>
<td>-.101</td>
<td>.385</td>
</tr>
<tr>
<td>Group</td>
<td>-.086</td>
<td>.442</td>
</tr>
<tr>
<td>EF</td>
<td>.073</td>
<td>.596</td>
</tr>
<tr>
<td>BUN</td>
<td>.163</td>
<td>.273</td>
</tr>
<tr>
<td>Creatinine</td>
<td>-.054</td>
<td>.715</td>
</tr>
<tr>
<td>BNP</td>
<td>.091</td>
<td>.628</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>.108</td>
<td>.390</td>
</tr>
<tr>
<td>Medications</td>
<td>.069</td>
<td>.610</td>
</tr>
<tr>
<td>Digoxin</td>
<td>-.013</td>
<td>.917</td>
</tr>
</tbody>
</table>
Summary of Results

1. Anthropometric and medical characteristics of subjects were statistically similar in both group
2. Groups statistically similar at baseline for outcome measures (p>0.05)
3. Subjects in both groups significantly improved scores on all functional measures and QOL over time. (Within subjects effect p=0.00)
4. Significant between subjects effect noted for 30-CRT (p=0.04) and QOL (p=0.02)
5. Significant interaction effects noted for GS (p=0.03) and TUG (p=0.02).
6. No significant differences in readmission rates.

Discussion

- This is the first randomized controlled study that specifically focuses on PT for patients in home care after an acute hospital admission.
- The study specifically focuses on the dosage of PT and its effects on function, QOL and readmissions in persons with HF.

Frontloading and Readmissions

- Overall Readmission rate for the sample is 25%; Similar to prior research
  Desai and Stevenson, Circulation; 2012
- This study provides no evidence on reduced readmissions with frontloading PT visits; contrary to research done in nursing.
Potential Explanations for Lack of Significant Differences in Readmissions between Groups

- Quality of each visit
- Patient adherence
- Analysis of the severity or impact a particular comorbid diagnosis has on function and required PT care
  - Charlson Index

---

Meaningful Change in Function

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Researcher Publication</th>
<th>MDC</th>
<th>Change Intervention Group</th>
<th>Change Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>2MWT</td>
<td>Connelly &amp; Thompson PT Canada; 2009</td>
<td>↑ 40 feet</td>
<td>↑ 85 feet</td>
<td>↑ 43 feet</td>
</tr>
<tr>
<td>TUG</td>
<td>Ries et al. PTJ; 2009</td>
<td>↓ 4.09 sec.</td>
<td>↓ 10 sec.</td>
<td>↓ 8.45 sec.</td>
</tr>
<tr>
<td>Gait Speed</td>
<td>Perera et al. Jour Am. Geriar Soc; 2006</td>
<td>↑ 0.05 m/s small change</td>
<td>↑ 0.22 m/s</td>
<td>↑ 0.18 m/s</td>
</tr>
<tr>
<td>30-CT</td>
<td>Wright et al. JOSPT; 2011</td>
<td>↑ 2 rises</td>
<td>↑ 2.28 rises</td>
<td>↑ 2.64 rises</td>
</tr>
<tr>
<td>2MST</td>
<td>Not established</td>
<td>↑ 18.57 steps</td>
<td>↑ 11.13 steps</td>
<td></td>
</tr>
<tr>
<td>QOL</td>
<td>Riegel et al. Nurs Res; 2002</td>
<td>↑ 12.46 points</td>
<td>↑ 29 points</td>
<td>↑ 15 points</td>
</tr>
</tbody>
</table>

---

Implications for Clinicians and Payers

- First study to provide precise treatment effects following home PT on a variety of functional outcome measures and QOL.
- No significant differences in readmission rates between groups inform the payer and clinician that either protocol may be possibly utilized based on the unique needs of the patient.
4/7 Hypotheses and Results

Frontloading of visits will significantly:
1. Improve GS scores
   – Reject the null hypothesis (p=0.03)
2. Improve TUG test scores
   – Reject the null hypothesis (p=0.02)
3. Improve 30-CRT scores
   – Reject the null hypothesis (p=0.04)
4. Improve QOL with lower MLHFQ scores
   – Reject the null hypothesis (p=0.02)

Interpretation of Results

- Possibility of Type I error due to:
  • Groups different at baseline.
  • Large standard deviations.
  • Similar slopes for 30-CRT and QOL
  • Use of multiple outcome measures.

Improvement in QOL

- Additional support, guidance and feedback provided during a frontloaded methodology may have been the reason for improvements in QOL.

- Prior Research:
3/7 Hypotheses and Results

Frontloading of visits will significantly:

1. Improve 2MWT scores
   – Accept the null hypothesis
2. Improve 2MST scores
   – Accept the null hypothesis
3. Improve 30-day readmission rates
   – Accept the null hypothesis

Strengths of the Study

- High levels of internal and external validity.
  • Prospective, true randomization, concealed allocation, blinded assessments, multi-site.
- Large sample size
- Low attrition rate
- Reliability of measurements taken by 3 primary data collectors.

Limitations of the Study

- No specific measures to monitor the quality and dosage of care provided per visit.
- Treatment provided by several therapists with different levels of knowledge, experience and skill.
- Extent of patient adherence to home exercise, diet and medication intake was not recorded.
- Patient’s comorbidities were not categorized based on overall severity.
Recommendations for Future Research

- Replicate the study:
  - Utilize the Charlson Index in evaluating the overall severity of a patient’s comorbidities.
  - Utilize a formalized plan of activities and procedures to include at each visit.
  - Utilize a select group of clinicians for treatment.
  - Conduct a long term follow up of patients.

- Future Research:
  - Economic analysis to assess the cost effectiveness of frontloading visits.
  - MDC for outcome measures for patients with HF.

Stability - 2 important questions!!!

1. Is this patient medically stable to receive treatment today?

1. How do I determine the correct intensity (dose) of treatment relative to the patients level of heart failure?

Is the patient stable to receive treatment today?

- Measures of absolute stability at rest
  - Heart Rate
  - Blood pressure
  - Respiratory Rate
  - Pulse Oximetry

- Measures of relative stability at rest
  - Changes over time
    - Hemodynamic responses at rest
    - Edema
    - Lung sounds
    - Weight gain
Measures of Stability

- Dyspnea
- Orthopnea
- Paroxysmal nocturnal dyspnea
- Lung Auscultation
  - Pulmonary Crackles
- Jugular Venous Distention

Measures of Stability

- Paroxysmal nocturnal dyspnea (PND)
  - Sudden episodes of shortness of breath in the night.
  - Specificity: 84%, sensitivity 40% - indicating that presence of PND ruled in the presence of heart failure
- Orthopnea
  - Shortness of breath in the recumbent position
  - Specificity: 74%, sensitivity 22%

Specificity and Sensitivity of Measures of Stability

- Dyspnea
  - 50% specificity
  - 50% sensitivity
- Edema
  - 80% specificity
  - 36% sensitivity
- Displacement of PMI (>3 cm from midclavicular line)
  - 92% specificity
  - 91% sensitivity
- Pulmonary Rales
  - 70% specificity
  - 70% sensitivity

Gopal M., Karnath B. Hospital Physician, 2009
Edema

- 1+ (Trace): Slight; Barely perceptible depression.
- 2+ (Mild): 0-0.6 cm Easily identified depression (EID) with skin rebound in <15 seconds
- 3+ (Moderate): 0.6-1.3 cm EID with rebound 15-30 seconds
- 4+ (Severe): 1.3 -2.5 cm EID with rebound > 30 seconds.
- Girth measurements

Jugular Venous Distention

Just Look !

- Related to filling pressures
- JVD
  - 94% specificity
  - 39% sensitivity

Heart Sounds

- S3 heart sound
  - Low frequency, extra sound in early diastole
- Auscultation
  - You Tube: https://www.youtube.com/watch?v=GvHj7JRjHGE
  - poor reliability and correct identification of the S3 heart sound, especially in novice clinicians. (Lok, Chest, 1999)
- Clinical significance
  - 95% specificity in determining the presence of acute heart failure. (Wang, JAMA, 2005)
  - S3 heart sound is correlated with increased left ventricular end diastolic pressures (LVEDP) and pulmonary capillary wedge pressures (PCWP) with sensitivity of 30-50% and a specificity of 80-90%. (Marcus, JAMA 2005)
Decompensation in Heart Failure

- **Decompensation** – New or worsening signs/symptoms of dyspnea, fatigue or edema that lead to hospitalization or unscheduled medical care (MD visits or ED visits).

  - Felker et al. Amer Heart Journal, 2003

- Hallmark signs of Decompensation are related to:
  - Increased congestion
  - Increased ventricular cardiac filling pressures

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Signs of Decompensation and Hospital Readmission

- Patients with pulmonary crackles and S3 heart sound are present in more than 50% of all patients admitted to the ED for HF Decompensation.

- Patients with crackles and S3 heart sound had higher readmission rates than those without these signs.
  - Odds ratio for Pulmonary Crackles = 2.8
  - Odds ratio for S3 heart sound = 2.6


- Patients with Orthopnea had a 12.8 (1.7-99.7) times risk of readmission within 6 months compared to patients without this symptom.
  - Note: Small study (n=32) causing the confidence interval to be high.

- Each decline in NYHA functional classification was associated with a 3.4 (1.4-8.5) risk of readmission.

Knowledge of Heart Failure and Exacerbation

- Patients presenting in the ED with a HF exacerbation tended to have a self-care adherence score of 5.1 (10 reflecting best adherence).
- Further, knowledge of HF was significantly below the cut off point for adequate knowledge about the disease condition.
- Cross sectional study therefore no temporal sequence or control group to help us determine the causal mechanisms at play.
- Further, study solely looked at knowledge and belief with self-care and not at the patient’s capability in performing ADL’s and self care.


Perez –Moreno Study: Prognostic value of dyspnea and fatigue with activity

- Measured fatigue and dyspnea relative to the workload that elicited the symptoms.
- Results:
  - Change in fatigue symptoms with the same workload in 6 months was associated with a 55% increase risk for readmission. (Hazard ratio(CI)= 1.55 (1.24-1.94)
  - Change in dyspnea symptoms with the same workload in 6 months was associated with a 88% increase risk for readmission. (Hazard ratio(CI)= 1.85 (1.50-2.37)

- Are the changes in dyspnea, fatigue over time related to central irreversible changes or reversible changes?


What is the Relationship between Leg Extension Strength and Dyspnea

- Cross sectional study of patients with heart failure.
- Leg extension strength measured by hand held dynamometer.
- Results:
  - Subjects with higher leg extensor strength (by median split) had lower levels of dyspnea with ADLs, instrumental ADLs, and physical function.
  - The stronger subjects also walked on average 49.43 m further on the 6-minute walk test.
  - Patients with higher leg extension strength were more likely to be in NYHA class II, as opposed to class III or IV

What are the causal mechanism at play?

- Does higher leg extension strength results in less symptoms allowing the patient to achieve a lower level on the NYHA classification?
  
  OR

- Does worsening cardiac function associated with a higher NYHA functional class and more symptoms restrict movement leading to lower leg extension strength.

Treatment Interventions

- Aerobic exercise
- Interval training
- Strength Training
- Breathing Exercises
- Positioning
- Energy Conservation Techniques

Conclusions

- First study to report meaningful improvements in function and QOL in individuals with HF receiving 30 days of home PT immediately after a hospital admission.
- Significant treatment effect differences were found for GS, TUG, 30-CRT and QOL.
- No significant differences found for readmissions.
- Standardized care was not provided at each visit, no assessment of severity of comorbidities.
- Future studies should examine the use of a standardized intervention, assess severity of comorbidities, and long-term follow up to validate the effectiveness of frontloading home PT visits.
References

- Gopal M., Karnath B. Clinical Diagnosis of Heart Failure. Hospital Physician. 2009

References Continued