Aquatic Programs for people with Multiple Sclerosis
Yasser Salem, PT, PhD, NCS, PCS

Dr. Salem is a board certified Neurologic Clinical Specialist and a board certified Pediatric Clinical Specialist. Dr. Salem earned his PhD in physical therapy from the University of Central Arkansas. He also has an Advanced Master Degree in physical therapy with concentration in pediatrics, and he received his professional physical therapy education from Cairo University. Dr. Salem is an Assistant Professor in the Division of Physical Therapy, Long Island University. He teaches courses in examination and intervention of the clients with neurologic dysfunction, as well as content in neuroscience, neuropathology, pediatrics, and motor control. Dr. Salem has conducted continuing education courses and given numerous presentations at national and international meetings. He has published in a variety of journals including Neurorehabilitation, Stroke, Journal of Neurologic Physical Therapy, Journal of Aquatic Physical Therapy, Physical and Occupational Therapy in Pediatrics, and Disability and Rehabilitation. In addition, he has served as an editorial reviewer for several journals including European Journal of Neurology, Disability and Rehabilitation, Developmental Medicine and Child Neurology, and Journal of NeuroEngineering and Rehabilitation. He maintains clinical experience in adult and pediatric rehabilitation.

Abstract

The goals of this session are to 1) present the theoretical framework and recent empirical evidence regarding aquatic therapy for individuals with multiple sclerosis; and 2) highlight the use of aquatic therapy to improve gait and balance and to augment rehabilitation of those individuals. Aquatic therapy is a form of integrated exercise for individuals with neuromuscular disorders that provides an appropriate therapeutic environment that can be used to augment rehabilitation of those individuals. Over the last 20 years, a substantial body of evidence has accumulated to support the use of aquatic therapy for people with neuromuscular disorders. Various research studies demonstrate improvements in balance, gait, spasticity, strength, range of motion, cardiovascular endurance, fatigue, quality of life, and psychological well-being. This session will review common impairments seen in people with multiple sclerosis. The unique aspects and rational for using aquatic therapy for people with multiple sclerosis will be presented. The current evidence on the effects of aquatic therapy in people with multiple sclerosis will be presented to guide practical application of aquatic therapy. This session will present general guidelines for treatment design and uses of aquatic therapy to augment rehabilitation. I will discuss how to design effective and specific aquatic exercise and treatment strategies. This presentation will highlight the use of aquatic therapy to improve gait and balance and the transition to land based exercises in people with multiple sclerosis. Selected patient examples using videos of individuals with multiple sclerosis will be presented.
Aquatic Programs for People with Multiple Sclerosis

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Course Objectives

• Upon Completion of this session, participants will be able to:
  – Describe the clinical presentation of individuals with MS
  – Discuss impairments and functional limitations that can be addressed through aquatic intervention
  – Identify the unique aspects and benefits of aquatic therapy for individuals with MS
  – Overview current evidence that supports the use of aquatic intervention for people with MS
  – Present general guidelines for effective aquatic intervention for people with MS
  – Presents examples of aquatic intervention strategies for treatment of people with MS
  – Relate information presented to their current practice

What is Multiple Sclerosis?
What is MS

- Multiple sclerosis (MS) is a chronic progressive inflammatory-demyelinating disease of the central nervous system
- It is the most common cause of neurological disability in young and middle aged adults
  
  (Hauser and Oksenberg, 2006; Rodriguez et al, 1994)
- Affecting an estimated 400,000 people in the United States
  
  (Reingold, 2002)

What Causes MS

- The exact cause of MS is unknown
- Most researchers believe that it is caused by an autoimmune response that results in damage to myelin
- Several factors may trigger the immune response including genetics, gender, and environmental factors (e.g., a virus or toxic environmental substance)

Who Gets MS

- Most people with MS are diagnosed between the ages of 20 and 50
- Two to three times as many women as men have MS
- Genetic factors make certain individuals more susceptible than others, but there is no evidence that MS is directly inherited
- MS occurs more commonly among people with northern European ancestry,
**Pathogenesis – Understanding MS**

- Loss of myelin (plaques) in multiple areas, leaving scarred or sclerotic tissue – which gives the disease its name
- Demyelination results in loss of nerve conduction to and from the brain

![Damage Caused by MS](image)

**Pathogenesis – Understanding MS**

- Plaques are scattered throughout the CNS

- Common sites for plaques include:
  - Cerebral hemisphere
  - Optic tract
  - Brain stem
  - Spinal cord
  - Corticospinal tract

![Normal Conduction of Myelinated Nerve Fibers](image)
Course of the Disease/Types of MS

• People with MS will most likely experience one of four disease courses, each of which might be mild, moderate, or severe

• Benign
  — Mild early exacerbation followed by complete recovery

• Relapsing remitting
  — Approximately 50%
  — More frequent exacerbation followed by less complete recovery than in the benign form
  — No or mild disease progression

Course of the Disease/Types of MS

• Secondary-progressive
  — Following the initial period of relapsing-remitting MS, the disease worsens more steadily, with or without occasional flare-ups, minor recoveries (remissions), or plateaus

• Primary-progressive
  — Approximately 10%
  — Slowly worsening neurologic function from the beginning— with no distinct relapses or remissions
  — The rate of progression may vary over time, with occasional plateaus and temporary minor improvements
Clinical Picture

- Severity and clinical presentation are highly variable and may be unpredictable
- Multiple signs and symptoms

Clinical Picture

- Fatigue
- Heat sensitivity
- Weakness and paralysis
- Spasticity
- Visual impairments
- Sensory loss
- Ataxia and cerebellar disorders
- Loss of balance
- Pain
- Bladder and bowel dysfunctions
- Cognitive, behavioral and emotional disorders

Fatigue

- One of the most common symptoms of MS, occurring in more than 80% of people
- Is commonly described as a feeling of “exhaustion” or being “wiped out,”
- Sometimes take the forms of increased weakness with effort, metal fatigue or sleepiness
- Worsening occurs in mid-to-late afternoon
- Can significantly interfere with a person’s ability to function at home and at work
Heat Sensitivity

- Worsening of MS symptoms when they get overheated, either from weather, exertion, a hot shower, or too much sun
- Symptoms usually go away after body cools down

Weakness and Paralysis

- Varies according to the severity
- Weakness and paralysis can cause gait difficulty
- Weakness and paralysis can cause difficulty/inability to walk or perform ADL

Spasticity

- Commonly seen motor symptom
- Associated with exaggerated deep tendon reflexes, abnormal muscle synergy, and positive Babinski’s sign
- Can also interfere with gait and ability to perform ADL
- Although spasticity can occur in any limb, it is much more common in the legs
Visual impairments

• Very common (80% of the patients)

• Is the first symptom of MS for many people

• Visual problems may include:
  – Altered visual acuity
  – Loss of vision
  – Double vision
  – Nystagmus

Sensory Deficits

• Sensory deficits may include
  – Numbness
    – Common symptoms of MS, and is often the first symptom experienced by people with MS
  – Paresthesias
  – Dysesthesia
  – Hypoesthesia
  – Deep sensory loss – sensory ataxia
  – Pain

Ataxia and Cerebellar Disorders

• Lack of balance control
• Dyssmetria
• Dyssynergia
• Kinetic tremors
• Dizziness
• Vertigo
• Dysarthria
• Dysphagia
Loss of Balance

• Seen in patients with weakness, spasticity, sensory loss or ataxia

Pain

• Common in MS - 55% of people with MS had “clinically significant pain” at some time

• Pain may result from:
  – Neurogenic pain - damage to nerves in the CNS
  – Orthopedic pain

Cognitive, Behavioral, and Emotional Changes

• Are common in people with MS

• Vary in severity

• Cognitive, behavioral, and emotional changes may include, memory problems, attention, concentration, and learning deficits, problem solving disorders, executive functions disorders, irritability, emotional disturbances or depression
Bladder and Bowel Dysfunction

• Bladder dysfunction is a commonly seen symptom in patients with MS

• Bowel Dysfunction may include loss of control, constipation, or diarrhea

Why Aquatic/Water Works?

Why Aquatic/Water Works?
Physical Properties of the Water

• The natural properties of the water; including buoyancy, viscosity, pressure, and cohesion offer clinical benefits for the participants

National Swimming Pool Foundation ∙ 4775 Granby Circle ∙ Colorado Springs, CO 80919 ∙ (719)540-9119 ∙ www.nspf.org
Why Aquatic/Water Works?
Physical Properties of the Water

• The benefits of aquatic environment
  – More freedom and independence of movements that is difficult in land
  – Facilitates working in an independent, upright posture
  – Ability to explore movement strategies and patterns against gravity without anxiety or fear of falling
  – Practice and challenge balance strategies, without anxiety or fear of falling

• The benefits of aquatic environment cont.
  – Ability to begin practicing upright postural activities against gravity before being able to achieve these activities on land
  – Reduction in proprioceptive feedback from the buoyance effects creates a sensory conflict and may stimulate the sensory system
  – Cool water temperature helps to keep core body temperature low, reducing the changes of overheating and fatigue
  – Reduce muscle tone and spasticity

• The benefits of aquatic environment cont.
  – Water turbulence and resistance during movements challenge the systems involved in balance
  – Ability to perform movements and increase muscle force and activities without increase in fatigue
  – A cool exercise environment which can increase endurance with activity
  – Can easily modify degree of difficulty by changing the speed and direction of movement in water
Aquatic Programs for People with MS

- Aquatic exercise program is a well-tolerated form of integrated exercise for individuals with MS  
  (Brown, 2005)
- Advocated by the National Multiple Sclerosis Society (NMSS)  
  (Pariser 2006)  
  (Roehrs and Karst, 2004)
- Recommended by clinicians on an increasing basis as a valuable adjunct to traditional treatment  
  (Pariser 2006)  
  (Roehrs and Karst, 2004)
- Often used to augment rehabilitation of those individuals

- Can be used to meet goals such as increased function and sense of well-being
- Can be used to augment rehabilitation of people with MS
- Provide opportunity to engage in regular moderate activity
- Form of socialization and exercise
Aquatic Programs for People with MS

What is the evidence?

What is the evidence

• The efficacy of aquatic therapy for improving functions in individuals with MS has received attention in recent years

• Although there is a limited number of studies evaluating the effectiveness of aquatic exercise for multiple sclerosis, those that have been conducted consistently demonstrate positive outcomes.

What is the evidence

• Gehlsen et al. (1984)
  – Ten ambulatory subjects with MS
  – Ten weeks of aquatic training
  – Aquatic training increased work capacity and fatigue resistance of the knee flexor and extensor muscles, and improved upper extremity work, force, and power

• Gehlsen et al. (1986)
  – Eleven subjects with MS
  – Ten weeks of aquatic training
  – No changes in gait parameters
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<th>What is the evidence</th>
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<tr>
<td><strong>Stuifbergen (1997)</strong></td>
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<td>– Four women with MS</td>
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<td>– Six-week aquatic exercise class</td>
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<td>– Improvements in self-reported quality of life in the four women with MS</td>
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<td><strong>Sutherland et al. (2001)</strong></td>
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<td>– Compared a 10-week water aerobic exercises to a control group</td>
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<tr>
<td>– Twenty two individuals with MS</td>
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<td>– Significant improvements in quality of life and psychological wellbeing in the training group (n=11) as compared to the control group (n=11)</td>
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<tr>
<td><strong>Roehrs and Karts (2004)</strong></td>
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<tr>
<td>– Nineteen individuals with MS</td>
</tr>
<tr>
<td>– Twelve-week aquatic exercise program</td>
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<td>– Significant improvements in the QoL domains of social functioning and fatigue</td>
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<tr>
<td><strong>Peterson (2001) - case report</strong></td>
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<tr>
<td>– A 33 years old female patient MS during an exacerbation</td>
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<tr>
<td>– Six-week of aquatic exercise program</td>
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<td>– Improvements in mobility and muscle strength and did not experience fatigue or any adverse change in neurologic status</td>
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<tr>
<td><strong>Pariser et al. (2006)</strong></td>
</tr>
<tr>
<td>– Two individuals with MS</td>
</tr>
<tr>
<td>– 8-week aquatic training program</td>
</tr>
<tr>
<td>– Improvements in cardiovascular fitness</td>
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<td>– Changes in fatigue were equivocal for participants</td>
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Our Program

Participants

• Individuals with MS

• Recruited through the NYC Chapter of the National Multiple Sclerosis Society (NMSS)

• All subjects signed an informed consent approved by the Long Island University Institutional Review Board

Participants

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<th>Inclusion Criteria</th>
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<td>1. A medical diagnosis of multiple sclerosis</td>
<td>1. Debilitating illness before or during the study</td>
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<td>2. Limited physical activity prior to participation in the study</td>
<td>2. Surgical procedure during, or up to one year prior to the study</td>
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<td>3. Capable of giving informed consent</td>
<td>3. Botox or ITB during or up to 6 months prior to the study</td>
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<td>4. A medical clearance for exercise participation</td>
<td>4. Unable to follow commands</td>
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<td>5. A medical condition that preclude exercising</td>
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Assessment

- All assessment one week before and after the training program

Assessment

- The 10-meter Walk Test
- The Berg Balance Scale
- The Timed “UP & Go” Test
- Dynamometer Grip Strength
- The Modified Fatigue Impact Scale
- SF-36 – Quality of Life

Training Program

- Originally designed by NMSS
- Implemented in several local community settings sponsored by the local chapter of the NMSS.
- Validated by a panel of faculty from physical therapy, occupational therapy, and sports science programs and a certified aquatic instructor.
Training Program

- Four – 10-week classes
- 60-minute sessions
- 2 X per week
- 10 weeks
- Accessible pool
- Water temperature 31°C

Training Program

- Group aquatic program
- Led by a certified aquatic instructor
- Assisted by graduate students:
  - Physical therapy, occupational therapy, and sports science programs
  - Received training sessions:
    - Two from a PT who is a Neurology Certified Clinical Specialist
    - One from an aquatic instructor
- Supervised by faculty from physical and occupational therapy programs

Training Program

- Warm-up period
- Aquatic exercises
- Cool-down period
Training Program

• Warm-up and cool-down periods
  – Low-intensity aerobic exercises
    • Breathing exercises
  • Flexibility
    • Neck, arms, and legs movements such as arm circles

• Aqua exercises included activities focused on:
  – Joint mobility, muscle strength, weight shifting, balance, and posture
  – Functional activities such as balance and walking
Results

- Aquatic exercise program improved walking function, balance, strength, fatigue, and quality of life
Results

- The appreciative responses of the participants in a satisfaction survey about the program support the feasibility

- All participants reported:
  - No incidence of falls
  - No increase in fatigue level, and
  - No adverse effects related to the exercise program

  - Enjoyed the program
  - Were either satisfied or very satisfied

What We Learned

- Aquatic exercise programs are feasible

- Aquatic exercise programs are beneficial for people with MS to improve physical functions such as strength, balance and walking

- Aquatic programs can be beneficial to improve quality of life and well-being

- Aquatic programs can be used to augment the rehabilitation of people with MS
What We Learned

• Health professionals, can consult with the community center and educate the staff on the exercises and nature of health conditions and specific precautions related to health condition or disability

• Critical to the successful development and implementation of a community-based program is the collaboration of the program team
  – The successful collaboration in this program may serve as a model for other community-based programs to expand service delivery for individuals with disabilities

What We Learned

• Several factors should be considered when designing and implementing community-based exercise programs for individuals with disabilities:
  – Identifying appropriate participants
  – Structuring meaningful training activities
  – The ratio of participants to support staff
  – Intensity, frequency, and duration
  – Group versus individual training
  – Suitability and safety of the training environment

Aquatic Exercise Activities
References


