Making Waves With Aquatic Therapy

By Lisa Iannucci

A growing number of PTs are incorporating aquatics into physical therapy interventions, helping a wider range of patients and clients.

Sarah Killian, PT, MSPT, ATRIC, recalls a recent patient. He was a male in his 60s diagnosed with a massive rotator cuff tear. He was experiencing a high level of pain and was unable to lift his arm. His physician anticipated that the patient would have to undergo surgery. Aquatic therapy was incorporated into his physical therapy plan of care, allowing the patient to perform exercises that would have been impossible on land.

Ultimately, the patient was able to avoid rotator cuff surgery. That, Killian says, helps demonstrate the added dimension that aquatic therapy can add to physical therapy interventions. Killian is a physical therapist (PT) with Hospital for Special Surgery Sports Rehab and Performance Center in New York.

A growing number of PTs are turning to aquatic physical therapy to treat patients with myriad health conditions. Water therapy has been shown to help joint pain and stiffness, muscle spasms, back pain, osteoarthritis, rheumatoid arthritis, fibromyalgia, lymphedema, systemic lupus erythematosus and much more, the PTs interviewed for this article say. [See "Research Supports Aquatic Interventions"]

"Over the last 20 years, a substantial body of evidence has accumulated to support the use of aquatic therapy for children and adults with musculoskeletal, neuromuscular, and cardiopulmonary disorders," says Yasser Salem PT, PhD, associate professor in the Department of Physical Therapy at University of North Texas Health Science Center. "Also, adults who have had strokes, multiple sclerosis, and Parkinson disease can benefit from aquatic therapy to improve balance, strength, walking, functional abilities, and their ability to perform activities of daily living."

The Benefits of Water

What makes water such a well-tolerated form of exercise and an effective adjunct to land-based physical therapy? "It allows for non-weight-bearing or limited weight-bearing exercises, promotes relaxation, decreases muscle spasms, increases range of motion, improves circulation, increases the efficiency of the respiratory system and cardiac output, and decreases edema and muscle lactate," says Karen Good, PT, OCS, ATRIC, senior physical therapist at the Kennedy Krieger Institute in Baltimore, Maryland.


Good


Hardy


Studer


Hoy

Water also reduces the risk of injury and provides security to the patient. "The patients can lose their balance and know they aren't going to fall immediately [and injure themselves]," says Mike Studer, PT, NCS, CEEAA. Studer is president and co-owner of the Northwest Rehabilitation Associates in Salem, Oregon, and vice president of APTA's Neurology Section.

"We have an 80-year-old male patient with neuropathy who had a long history of falls," explains Studer. "He has painful arthritic joints, limiting his ability to engage in therapy, but he walks in the water. It doesn't hurt because of the buoyancy. And he knows that if he loses balance, he'll just make a splash and not fall on the ground, so he can regain his balance in a non-threatening environment."

Studer explains that in some situations, especially postsurgical, aquatic therapy is only temporary, designed to improve early mobilization. "We then progress them on to land-based exercises before discharge," he says. "As the science of geriatric rehabilitation has improved, we're less fearful about increasing the dosage of exercise. We know that patients who are older can improve strength and endurance. It's a gradual process, but research shows that we can expect improvements."

When Leonard Hardy, PTA, BS, ATRIC, began in aquatic therapy in 2007, he didn't see many geriatric patients in the water. "Many skilled nursing facilities don't have pools because they are expensive," he says. "Many outpatient facilities typically contract out to the local YMCA, community pools, or university pools to provide aquatic therapy services. In the majority of these pools, the temperatures are too cold for geriatric clients. Community pools often maintain temperatures of 86 to 88. We maintain our pool at a temperature of 91-93 degrees." Hardy is with Tender Touch Rehab Services in Lakewood Township, New Jersey.

Hardy describes the benefit of water therapy for 1 particular patient who had a total knee replacement. "The patient had active range of motion (AROM) of -10 to 75 degrees 3 days post-op and needed a roller walker for ambulation," says Hardy. "The patient was unable to ascend and descend stairs. Balance was poor.'

Not a good situation for a patient who had to climb 5 stair steps to get into his home and 15 stair steps once inside. The patient first received land-based physical therapy. Then aquatic therapy was added.

"After 1 week the patient's AROM increased to -3 to 90 degrees," Hardy says. "After 2 weeks, the AROM increased to 0 to 97 degrees, and the patient was able to ambulate without an

Storm Warnings

Although aquatic therapy offers many benefits to patients with a variety of ailments and conditions, there are also some cases in which it shouldn't be used. They include:

- Patients with infectious or water borne diseases.
- Patients with open wounds. "Wounds can become infected," says Hardy. "If the patient has a wound from surgery, we request approval from the surgeon or physician before aquatic therapy. Additionally, even after medical clearance I put a special dressing over the wound to protect from infection."
- Patients with severe seizures.
- Patients with fixed contractures. "This is a joint that can't move fully through a range of motion or is stuck in that position," says Karen Good, PT, OCS, ATRIC, senior physical therapist at the Kennedy Krieger Institute.
- Those with a fear of water.
- Patients who are incontinent.
- Patients who are on oxygen or monitored by cardiac rehab. "The patient's heart rate increases because of hydrostatic pressure of the water," says Hardy. "So, we can't monitor their heart rate in the water."
- Some obese patients. "We have had an influx of obese patients in our facility," says Hardy. "Patients who are obese need lower water temperatures so their heart rate and blood pressure will remain normal. Temperatures higher than 90 degrees are not appropriate for patients who are obese. When I have such patients, I have to drop the water temperature to accommodate them. Unfortunately, in my pool it takes 2 hours to drop the temperature 1 degree. So it really requires planning for treatments with patients who are obese and those with high blood pressure."

assistive device and ascend and descend stairs safely. His balance improved. I believe that if aquatic and land-based physical therapy had been used earlier, the patient would have gone home much sooner."

Wounded Warriors

The Walter Reed National Military Medical Center in Bethesda, Maryland, uses aquatic therapy to treat many of its military patients with injuries ranging from lower back or knee pain to post-operative total joints. "And we treat a special population of polytrauma patients (combat injuries in Afghanistan and Iraq) with amputations, limb salvage, and/or traumatic brain injury," says Allison Hoy, PT, a physical therapist at Walter Reed.

Hoy used aquatic therapy to help treat a 28–year-old Marine injured from an IED blast in Afghanistan. The Marine had suffered multiple injuries to his right hand and lungs. Both of his legs had been amputated. "Rehabilitation in the water allows him to work on his balance, core stability, strengthening, and cardiovascular endurance without the difficulties of being full weight bearing," says Hoy. "He's also experienced an increase in flexibility because he can use the buoyancy properties of the water to stretch."

The prosthetists at Walter Reed even constructed a prosthetic leg for the patient to use in the pool. "The leg allows him to progress through his standing balance exercises and gait training with less pain and ease of movement than if he were on land," she says. "It assists him in learning to swim again with greater propulsion."

Aquatics for Athletes

In addition to helping patients with health conditions, Studer says, he also credits aquatic therapy with helping extend the careers of athletes. "It can help an aging NBA star or a community-based athlete who wants to compete in 1 more marathon or triathlon," says Studer. "Before aquatic therapy, they would practice by pounding on land. We haven't conducted research to know how many years it adds, but potentially it might be 10-15 or more years."

Killian has worked with a range of high-level athletes, including marathon runners, skiers, basketball players, climbers, soccer players, and—yes—even swimmers. Athletes pose their own sets of challenges. Killian explains, "Athletes already are at a very high level of fitness. The aquatic environment lets athletes


Ennis

maintain a high level of cardiovascular fitness and core stability that they may not have been able to maintain on land."

The mindset of the athlete often differs from that of other patients. "You need to make sure the athlete understands that the healing process takes time, and that following a proper rehab progression takes time. It's getting them to buy into the fact that if they let the healing happen when it's supposed to, they'll recover better. So patient education is very important during the rehab process," Killian says.

Another difference when working with athletes can involve immediate versus long-term goals. Killian explains, "Our approach depends on where in the competitive season the athlete is and the level of the athlete. For example, if a swimmer is in the midst of championship competition, you're not going to pull him or her out [unless it's absolutely necessary]. But you do your best at the time. And then, during the off-season, you may devote more time to rehabilitation."

That, in turn, highlights the importance of communication. "Communication with others can make the rehab process run as smoothly as possible. Touching bases with coaches regarding limitations and activity modification is very important. For instance, if you're working with a swimmer, perhaps altering the workout or reducing the amount of yardage is appropriate. And being in touch with the athletic trainer, to make sure that the training is complementing the PT's program, is crucial," she says.

Guppies and Minnows

Aquatic therapy is beneficial for children as well. "Children with such conditions as cerebral palsy, autism, and Down syndrome benefit from aquatic therapy to enhance motor, sensory, cognitive, and social development skills," says Salem.

When Beth Ennis, PT, EdD, PCS, ATP, of All About Families

Research Supports Aquatic Interventions

Presented below is a sampling of the research on the benefits of aquatics.

Autism Spectrum Disorder

Fragala-Pinkham MA, Haley SM, O'Neil ME. Group swimming and aquatic exercise programme for children with autism spectrum disorders: a pilot study. *Dev Neurorehabil.* 2011;14(4):230-41. doi: 10.3109/17518423.2011.575438.

Pan CY. Effects of water exercise swimming program on aquatic skills and social behaviors in children with autism spectrum disorders. *Autism.* 2010 Jan;14(1):9-28.

Vonder Hulls DS, Walker LK, Powell JM. Clinicians' perceptions of the benefits of aquatic therapy for young children with autism: a preliminary study. *Phys Occup Ther Pediatr.* 2006;26(1-2):13-22.

Fibromyalgia

Assis MR, Silva LE, Alves AM, Pessanha AP, Valim V, Feldman D, Neto TL, Natour J. A randomized controlled trial of deep water running: clinical effectiveness of aquatic exercise to treat fibromyalgia. *Arthritis Rheum.* 2006 Feb 15;55(1):57-65.

Evcik D, Yigit I, Pusak H, Kavuncu V. Effectiveness of aquatic therapy in the treatment of fibromyalgia syndrome: a randomized controlled open study. *Rheumatol Int.* 2008 Jul;28(9):885-90. Epub 2008 Feb 16.

Gusi N, Tomas-Carus P. Cost-utility of an 8-month aquatic training for women with fibromyalgia: a randomized controlled trial. *Arthritis Res Ther.* 2008;10(1):R24. Epub 2008 Feb 22.

Munguía-Izquierdo D, Legaz-Arrese A. Assessment of the effects of aquatic therapy on global symptomatology in patients with fibromyalgia syndrome: a randomized controlled trial. *Arch Phys Med Rehabil.* 2008 Dec;89(12):2250-7.

Munguía-Izquierdo D, Legaz-Arrese A. Exercise in warm water decreases pain and improves cognitive function in middle-aged women with fibromyalgia. *Clin Exp Rheumatol.* 2007 Nov-Dec;25(6):823-30.

Tomas-Carus P, Häkkinen A, Gusi N, Leal A, Häkkinen K, Ortega-Alonso A. Aquatic training and detraining on fitness and quality of life in fibromyalgia. *Med Sci Sports Exerc.* 2007 Jul;39(7):1044-50.

Elite Athletes

Kim E, Kim T, Kang H, Lee J, Childers MK. Aquatic versus land-based exercises as early functional rehabilitation for elite athletes with acute lower extremity ligament injury: a pilot study. *PM R.* 2010 Aug;2(8):703-12. Epub 2010 Jul 3.

Martel GF, Harmer ML, Logan JM, Parker CB. Aquatic plyometric training increases vertical jump in female volleyball players. *Med Sci Sports Exerc.* 2005 Oct;37(10):1814-9.

Thein JM, Brody LT. Aquatic-based rehabilitation and training for the elite athlete. *J Orthop Sports Phys Ther.* 1998 Jan;27(1):32-41.

Osteoarthritis

Arnold CM, Faulkner RA. The effect of aquatic exercise and education on lowering fall risk in older adults with hip osteoarthritis. *J Aging Phys Act.* 2010 Jul;18(3):245-60.

Bartels EM, Lund H, Hagen KB, Dagfinrud H, Christensen R, Danneskiold-Sams0e B. Aquatic exercise for the treatment of knee and hip osteoarthritis. *Cochrane Database Syst Rev.* 2007 Oct 17;(4):CD005523. Review.

Cadmus L, Patrick MB, Maciejewski ML, Topolski T, Belza B, Patrick DL. Community-based aquatic exercise and quality of life in persons with osteoarthritis. *Med Sci Sports Exerc.* 2010 Jan;42(1):8-15.

Hale LA, Waters D, Herbison P. A randomized controlled trial to investigate the effects of water-based exercise to improve falls risk and physical function in older adults with lower-extremity osteoarthritis. *Arch Phys Med Rehabil.* 2012 Jan;93(1):27-34. Epub 2011 Oct 7.

Hinman RS, Heywood SE, Day AR. Aquatic physical therapy for hip and knee osteoarthritis: results of a single-blind randomized controlled trial. *Phys Ther.* 2007 Jan;87(1):32-43. Epub 2006 Dec 1.

Wang TJ, Belza B, Elaine Thompson F, Whitney JD, Bennett K. Effects of aquatic exercise on flexibility, strength and aerobic fitness in adults with osteoarthritis of the hip or knee. *J Adv Nurs.* 2007 Jan;57(2):141-52.

Other

Becker BE. Aquatic therapy: scientific foundations and clinical rehabilitation applications. *PM R.* 2009 Sep;1(9):859-72.

Driver S, Rees K, O'Connor J, Lox C. Aquatics, health-promoting self-care behaviours and adults with brain injuries. *Brain Inj.* 2006 Feb;20(2):133-41.

Ferrell KM. Aquatics for people with arthritis. *Lippincotts Prim Care Pract.* 1998 Jan-Feb;2(1):102-4.

Fragala-Pinkham MA, Dumas HM, Barlow CA, Pasternak A. An aquatic physical therapy program at a pediatric rehabilitation hospital: a case series. *Pediatr Phys Ther.* 2009 Spring;21(1):68-78.

Getz M, Hutzler Y, Vermeer A. Effects of aquatic interventions in children with neuromotor impairments: a systematic review of the literature. *Clin Rehabil.* 2006 Nov;20(11):927-36. Review.

Lim JY, Tchai E, Jang SN. Effectiveness of aquatic exercise for obese patients with knee osteoarthritis: a randomized controlled trial. *PM R.* 2010 Aug;2(8):723-31; quiz 793.

PLLC in Louisville, Kentucky, started as a physical therapist more than 2 decades ago in Arizona, her facility's 2 pools only handled patients with musculoskeletal issues as joint replacement, arthritis, and ACL repairs.

Today, pools are used for many patients, including children with special needs. Ennis notes that children with autism spectrum disorders (ASD) tend to have low muscle tone, poor coordination, and difficulty with social skills. She recently conducted small trials to see if children with ASD would benefit from water therapy.

The effects surprised her. The benefits seemed to go beyond gross motor skill improvement. "When we got the kids into the water to strengthen their motor skills, we saw improvements in communications, social skills, and interactions that we hadn't planned on," says Ennis.

Her program is designed to allow children and families to participate in a community-based, therapeutically beneficial activity. She uses simple equipment, such as kickboards, squirt guns, and float mats that families can purchase on their own and use in a home or community pool with their child.

For More Information

The goal of APTA's Aquatic Physical Therapy Section's is to meet the needs of physical therapists interested in using the water for various aspects of their careers and provide a means by which association members with an interest in aquatic therapy can meet, exchange, develop, and promote aquatic therapy as an important component to the physical therapy profession. It has 973 members.

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"Kickboards are for balance and coordination," she explains. "The squirt guns teach eye/hand coordination. Monkey walking exercises help with bilateral coordination. There's a lot we can do, but the equipment is minimized so they can continue with aquatic activities afterward."

Some children with autism may pose behavioral challenges while in the water, Ennis says. "This is a different environment for them and they have challenges with sensation. Some children don't like having water on their head in a bathtub, so being in a pool can be overwhelming. Some dislike touch," she says. "We have to remind ourselves to be slow and patient and not expect the moon. But once you get them in the water, often it is a challenge to get them out, because they enjoy it so much."

Ennis and her team typically work with a child for 1 hour a week for 8-10 weeks. "We once had a second 10-week session. Although we still saw improvements, it wasn't nearly as dramatic as the first 10-week session. So now we work on getting them acclimated to the water. Then we send them off with a home program," she says. "Later, we survey the family to see how it is going. Aquatics is fun and can be a normalizing activity to get families reengaged in the community while still providing therapeutic benefits."

Evolving Technologies and Techniques

The recent popularity of aquatic therapy has fueled advancements in its equipment and techniques. "Ten years ago, PTs primarily were using foam barbells and noodles to perform pool exercises. Although those still are being used today, new types of paddles, fins, and adaptive equipment are being invented every year," says Hoy.

Good adds, "Other advances are being introduced into aquatics as well, such as Ai Chi and more advanced lumbar stabilization and core exercises." Good is a certified trainer in Ai Chi, an aquatics exercise that uses slow Tai Chi movements.

Good says, "Ai Chi may be an ideal approach to use with patients who are in pain, or who need more awareness of their own movements through space. My role is to use the basic properties of water together with advanced technology such as video, treadmill, and aquatic tools to enhance movement, build strength, and restore function. I see myself as innovative not just in what I use, but how I use it. I believe that, if it's not fun, it doesn't matter how 'cool' it is."

On the equipment front, some of Studer's patients walk on an underwater treadmill, an increasingly popular piece of aquatic equipment. Studer's treadmill is in a 2,700 gallon pool "The entire floor of our pool is a treadmill," he says. "We have windows in the pool. We use a video camera to analyze patient movement. This shows us the patient's leg movement. We can use what we see to better help our patients."

Good, who has a similar setup, says, "We can make sure [the patient's] walk is symmetrical. We can see the length of the stride and how much the knee flexes." Underwater cameras project the image of the patient's therapy onto monitors, which allows both the patient and PT to watch and adjust the walking or running motion.

The technology allows PTs to challenge a full range of individuals of all ages and all physical conditions—from the sedentary and the elderly to high-level athletes—because of the treadmill's speed. "And hydropressure allows the PT to direct a flume of water while the patient is attempting to walk or run forward," says Good, who adds that even patients who can't move themselves on dry land—often bariatric patients or those with cerebral palsy—

often are able to walk on underwater treadmills with assistance.

For aquatic therapy to succeed, Hardy says it's vital that therapists actually get in the water. "Getting in the pool helps the PT monitor body mechanics and safety. And if the patient loses balance and goes under the water, the therapist is close by to help."

Looking Ahead

Going forward, Studer says that he'd like to see underwater treadmill use become even more widespread in physical therapy interventions. "It's a well-kept secret. Some people feel that they can imitate the treadmill by walking on the bottom of the pool, but there's no comparison for the level of intensity that the treadmill can provide," he says.

Killian sees several trends. One is a greater incorporation of aquatic therapy in the rehabilitation plans of patients. But, she said, additional research is needed in the area of aquatics. Another trend is a growth in the use of pools especially designed for therapeutic uses, allowing for adjustment of water flow and quick changes in temperature. But if that's not available, "There's plenty that you can do in a regular pool," Killian says.

As with most technologies and evidence-based interventions, there are constant advances in aquatic therapy. "Aquatic therapy has more applications, reaching a broader range of patients than most therapists had envisioned," says Studer. "The benefits of new technology with the classic principles of aquatic therapy enable us to be even more intense and specific. This gives us an excellent option of an environment to help some patients improve faster and more completely." **PT**

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References

1. American Physical Therapy Association. Demographic Profile of Physical Therapist Members. www.apta.org/WorkforceData/ Accessed June 14, 2012.
2. American Physical Therapy Association. Demographic Profile of Physical Therapist Assistant Members. www.apta.org/WorkforceData/ Accessed June 14, 2012.
3. DePasquale L, Toscano L. The spring scale test: a reliable and valid tool for explaining fall history. *J Geriatr Phys Ther.* 2009;32(4):159-167.