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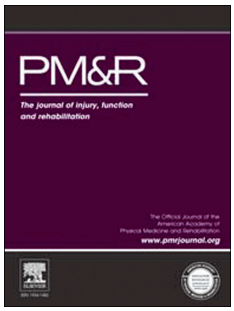

Case Report: Aquatic Therapy and End-Stage Dementia

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Title: **Case Report: Aquatic Therapy and End-Stage Dementia**

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Title: **Case Report: Aquatic Therapy and End-Stage Dementia**

Key Words:

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Abstract:

A 54-year old female, retired due to progressive cognitive decline, was diagnosed with early-onset Alzheimer's dementia. Conventional medication therapy for dementia had proven futile. Initial evaluation revealed a non-verbal female seated in a wheelchair, dependent on 2-person assist for all transfers and activities of daily living (ADLs.) She had been either non-responsive or actively resistive for both ADLs and transfers in the 6 months prior to assessment. Following a total of 17 one hour therapy sessions over 19 weeks in a warm water therapy pool, she achieved ability to tread water for 15 minutes, transfers improved to moderate to-maximum assist from seated, ambulation improved to 1000' with minimum-to-moderate assist of 2 persons. Communication increased to appropriate "yes," "no," and "OK" appropriate responses, occasional "thank you" and "very nice." The authors propose that her clinical progress may be related to her aquatic therapy intervention.

Introduction

The role of exercise in the preservation and improvement of cognitive function is becoming well-established science.[1, 2] Even in the case of dementia, exercise science has established a body of both human and animal research demonstrating a strong role for aerobic activity.[3-5] There are as yet no medications that can consistently maintain cognitive ability, much less reverse the course of diseases such as Alzheimer's disease.

Simple aquatic immersion produces increases in cardiac output and cerebral blood flow that may parallel some of the general physiologic effects of exercise, but whether aquatic immersion alone is therapeutically useful in dementia remains an important unanswered question.[6] There is an emerging body of literature demonstrating clinical benefits from participation in an aquatic exercise program in mild to moderate Alzheimer's disease.[7-10] Studies are as yet small, but results are promising and the clinical implications for the therapeutic management of this troublesome disease merit more research, although the question of immersion benefits versus aquatic exercise benefits remains.

To our knowledge, we present the first case report of the use of aquatic therapy for an individual diagnosed with end-stage Alzheimer's disease and severe behavioral issues who showed significant functional and behavioral gains, as well as speech and language gains over a period of 4 months of aquatic activity, initiating with passive therapies progressing to aquatic exercise. The potential physiologic rationale for these clinical improvements will hopefully spur further research.

Case Presentation

A female former physical therapist was diagnosed at age 53 with early-onset Alzheimer's disease following a neurologic assessment which included a PET scan. She underwent unsuccessful trials of memantine and donezepil as well as a clinical trial of rivastigmine transdermal patches. The patient had lived independently until her parents found her unable to safely continue in that environment and moved her to live with them until the living environment in their home had become impractical. Over the year following diagnosis she continued to deteriorate and was placed in a memory care residential facility. She was referred for physical therapy assessment at age 54. Because the patient had been an avid swimmer prior to her illness, a trial of aquatic therapy was encouraged by her family and initiated upon physician referral. At the time of her physical therapy assessment, the patient was alert but with very limited communication and scant ability to follow even single stage commands. Her medications consisted of calcium 650mg BID, acetaminophen 325 mg BID, carbidopa/levodopa 10/100mg QD, and PRN bisacodyl, apap/ hydrocodone 325/5 mg, and alprazolam 0.5mg. Her physician authorized a therapeutic trial of aquatic therapy, initiating the assessment by a physical therapist working with an experienced physical therapist assistant with extensive aquatic experience in cognitively impaired patients.

At the time of her initial physical therapy evaluation, the patient physically required total assistance of two staff members for all transfers and ADLs due to her being either non-responsive, or having episodes of very active resistance. The patient showed no signs of ability to perform, or even initiate weight bearing, even with total assistance. Her muscle strength was unable to be tested due to her inability to follow commands. The patient's family stated the patient could on occasion, propel herself using her legs in her wheelchair, but would not follow any directions. The patient had not taken steps, stood, or assisted with transfers in over six months.

Cognitively, the patient was given the mini-mental status evaluation (MMSE) prior to evaluation, but gave no direct response nor did she respond with direct eye contact or recognition that questions were being directed to her, with a consequent score of 0. She did not respond to direct questions, and would slap her thighs, looking away to the left and repeatedly reaching to touch the couch in a dissociative manner. The patient's family and facility caregivers stated that she would occasionally say the words "yes," "no" and "okay," but they were rarely appropriate and out of context. She would mostly grunt or make unintelligible syllables, but would occasionally give short bursts of gibberish. The family stated this had been her cognitive state for over six months.

Because the patient had failed in all prior attempts of land-based therapy and her family emphasis of her previous love of swimming and water, the trial of aquatic therapy was initiated. The patient's Plan of Care began for a period of 4.5 months. During this time period, she received 17 total aquatic therapy sessions, on a weekly basis with several missed weeks. The transport process to and from her care center to the aquatic facility required her transfer to her family's sport utility vehicle (SUV), as she became extremely agitated in a handicap transport van trial, and even in the SUV she needed to be seated in the back seat for safety. The commute was exhausting to family and remained so for a period of months, and required the care facility to administer alprazolam 30 minutes prior to transport on a number of visits over the 19 week period.

The initial sessions in the 89-90°F heated pool were significant for a dramatic reduction in agitation and facial expressions of anger with increased verbalization, including her calling out, "Hi Mom," to her mother who was present in the pool during the therapy session, which she had not done in over a year. During the pool sessions, she tolerated swaddling with a blanket, and modified Watsu techniques supine in the water. (Watsu is a passive aquatic technique derived from classic Shiatsu

massage which has been adapted into aquatic therapy practice. It is intended to create relaxation through gentle slow movements through a warm water environment while being held or supported by the aquatic therapist. It has been found successful in working with stroke, cerebral palsy and autism.)[11] She did not initially tolerate the upright posture in water until 45 minutes of supine activity and swaddling had been done. Modifications of Water Specific Therapy, based on the 10 points of the Halliwick Method, were incorporated during the treatment sessions utilizing metacentric effects to influence the patient's active participation. (The Halliwick Method was developed in the UK in the 1950s as a method of teaching swim readiness to disabled children using the properties of water in a highly structured progression, beginning with balance in water and progressing into movements incorporating rotation, static and increasingly dynamic activities. The method developed into a progressive 10-Point-Program (TPP) used to promote posture and balance control and exercises from this TPP became the basis for an aquatic therapy approach called Water Specific Therapy (WST) with the focus on objectives related to levels of function, structure and activity.)[12] Over subsequent sessions with the patient this preliminary supine activity required less time and functional patterns became more instinctive.

On her second pool visit she was able to exit the pool via a ramp walking 20' with minimum (Min) to moderate (Mod) assist. Walking on level ground improved dramatically also, to 75' on visit 6 with contact-guard-Min assist, increasing to 1000' with min-mod assist of 2 on visit 14. Also by the 6th visit, the patient began to show ability to tread water, initially for a few seconds but later for minutes, achieving ultimately 15 minutes per session. She gained ability to stand upright from a water-treading position, and then to walk, but preferred to swim and tread water. On later visits she was able to ascend the entire ramp length of greater than 50' with standby to Mod assist with rests and redirection. Her aquatic trial was formally terminated after the 15th visit, although she has continued

sporadic aquatic therapy 2-4 times per month. During her therapy visits no adverse events occurred. Her clinical progress is summarized in Table 1, with only odd numbered visits shown in the interest of brevity.

Carryover of mobility skills to her care center was short-lived, unfortunately. She remained wheelchair dependent. Over the months of her treatment and even following that period, her mother reported that her improved communication skills persisted. She demonstrated consistent yes/no response accuracy, and social comments such as appropriate "thank you" and "very nice" comments recurring as well as other appropriate verbalization. She continued episodic aquatic visits.

Discussion:

The pathophysiology of the various forms of dementia remain incompletely understood. Medication management is often minimally helpful, as in this case. Individuals with dementia pose a difficult management group both for residential facilities as well as for those striving to care for family members at home. Exercise has been shown to have a modulating effect upon dementia in recent studies.[13, 14] Several publications have noted cognitive as well as functional gains following courses of aquatic exercise in older adults, both community-dwelling and in residential facilities.[8, 9, 15, 16] In these publications improvements in measures of executive function, attention, and memory were noted even in quite brief exercise intervention periods.

Several physiologic alterations occurring during aquatic immersion may be participatory in the cognitive and functional changes noted in the above-referenced publications. Aquatic immersion produces significant alterations in the cardiovascular system, resulting in an increase in cardiac output and a decrease in peripheral vascular resistance.[6] It has been speculated that this cardiac

output increase is primarily distributed to the brain, muscles and kidneys. Two newer papers add support to this speculation by demonstrating alterations in cerebral blood flow during clavicle-depth immersion. Increases in both middle and posterior cerebral arterial flow velocities were noted both during sedentary immersion and during aquatic exercise.[17, 18] The relationship between dementia and cerebral blood flow may play a part of the cognitive and behavioral effects described above.

There is also a neurophysiologic autonomic alteration in sympathovagal balance produced during warm water immersion, as described in papers assessing cardiac vagal control.[19, 20] Warm water immersion produces a dramatic decrease in sympathetic cardiac influence with an increase in cardiac vagal control. The role of the autonomic nervous system in Alzheimer's disease has been well described,[21] with cognitive function positively associated with increased cardiovagal influence and negatively associated with increased sympathetic autonomic output. These effects may play an important role in this case report as well as in the blood flow papers cited above.

Some of the activities that our case study patient did in water included actual exercise, such as treading water, while others were simply passive, or low level ambulation. Heart rates were not monitored. Further trials should incorporate this simple metric to ascertain cardiac aerobic levels. Our patient received therapy only once per week, and increased treatment frequency may have achieved greater gains, so this should be addressed in future studies. Clinical gains may also relate to aerobic levels achieved, over and above simple immersion results. Trials of aquatic therapy in a broader range of dementia patients are needed, and since immersion trials cannot be blinded, other research methods may be used, assessing effect magnitude and durations specifically including cognitive status, communication/language skills and functional motor performance.

The role of aquatic therapy in the management of individuals with dementia has received little emphasis. Logistic difficulties are often present, concerns over incontinence are real (although often excessively emphasized,) and staffing to treat these individuals is often problematic. Such individuals require close hands-on in-water supervision for safety at the least, and ideally responsible on-deck support with lifesaving certification. While a number of residential facilities for the elderly have aquatic facilities, in both authors experience only rarely are these facilities extensively utilized. Yet there are very few therapeutic successes seen with currently available medications. Our patient was an avid prior swimmer, but positive results have been seen in Alzheimer's patients not as comfortable with the aquatic environment.[8, 9] No previous papers have addressed the issue of participant comfort in the aquatic environment although all referenced studies included individuals who were either regular swimmers, or had a past history of or interest in swimming. We suspect that hydrophobic individuals would not do as well. A warm-water aquatic environment produces a calming and relaxing effect upon humans across the age span from infancy through adulthood. This effect is therapeutic, increasing cardiac efficiency, lowering blood pressure, improving sleep patterns and positive effects on the endocrine system as well as the cognitive effects described.[6] The implications for its use in individuals with dementia are potentially quite profound, as the greying of our nation increases the population potentially at risk.

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Table 1

Visit	Behavior	Transfers (Assist needed)	Ambulation/ activity	Communication	Eye contact
Initial eval	agitated to unresponsive	max 2 persons	none	no words, no commands followed	none
1	agitated, calmed @45 min	max 2 persons	none	yes/no accurate, "Hi Mom," did follow some instruction	5 sec
3	more initial agitation	max 2 persons	limited but CGA-SBA, exited via 40' ramp CGA-Min	garbled language only	
5	less anxious, less initial agitation	max 1-2 person	CGA to deep, began sculling, dancing to music, exit ramp CGA to min	"Ok", followed most commands	much
7	mod anxious, agitation soon dropped	mod-max 1	30 sec-3 min treading CGA, self-correcting balance, exit ramp CGA-SBA	"thank you," appropriate	much
9	initial mod agitation, decreased during rx	max-mod 1	treading 8 'nonstop x 1, 5' x 1, 60' land CGA of 1, 150' land CGA of 2	appropriate yes/no, "scared," "thank you" x3, "nice, very nice"	much
11	less anxious, agitation dropped fast	min-mod	mod to ramp bottom, min-mod up, land 150' CGA of 2, then 400' CGA of 2	"thank you," appropriate, "Oh, my God," "tired," "please,"	more
13	much less anxious,	w/c max,	ramp down mod-max, treading much, exit ramp CGA x2, land 600' CGA-mod x2 with rests	"Oh, my gosh," "sure," appropriate, more vocal throughout	much
15	more agitation	sit-stand mod, w/c mod	entry amb unable, treading x multiple times,	"I want to say something," laughing but no further responses	much
17	agitation much less	mod-min car to w/c,	ramp down mod-max, much treading, ramp exit min-max, land 750' with CGA x2	identified staff by gender correctly, more	much more

Table 1

				words,	

CGA (contact guard assist)
SBA (standby assist)
Min (minimum assist)
Mod (moderate assist)