

Best Evidence Statement (BESt)

Date published / posted 1/4/11

Title: *Aquatic physical therapy combined with land-based physical therapy to improve functional independence*

Clinical Question

P (population/problem) Among children with acquired neurological impairments
I (intervention) does aquatic physical therapy combined with land-based physical therapy
C (comparison) versus land-based physical therapy alone
O (outcome) improve functional independence?

Target Population:

Inclusion: Children with acquired neurological impairments (ages 0 to 21) which includes diagnoses such as traumatic brain injury, spinal cord injury, brain tumor, meningitis, encephalitis, transverse myelitis, cerebrovascular accident (CVA), and Guillain Barre.

Exclusion: Patients with neurological impairments that are hereditary, present at or around the time of birth, or degenerative including, but not limited to cerebral palsy, muscular dystrophy, and spina bifida.

Recommendation (See Table of Recommendation Strength following references)

There is insufficient evidence and a lack of consensus to make a recommendation on the effectiveness of aquatic physical therapy combined with land physical therapy versus land physical therapy alone in children with acquired neurological impairments.

Discussion/summary of evidence

Review of the aquatic therapy literature reveals no evidence to support the use of aquatic physical therapy combined with land-based physical therapy versus land-based physical therapy alone in children with acquired neurological impairments.

Aquatic physical therapy is an effective modality that can be used with many different types of patients to improve outcomes and achieve physical therapy goals (Ruoti, Morris, & Cole, 1997, [5]). In patients who are receiving neuro-rehabilitative physical therapy the aquatic environment can be used to work on skills which the patient/client is not able to safely complete on land, thus potentially speeding rehabilitation. Combining land-based physical therapy with aquatic physical therapy may help to facilitate recovery of function in adults with acquired neurological impairments (Degano & Geigle, 2009, [5a]; Stowell, Fuller, & Fulk, 2001, [5a]).

Aquatic therapy has been shown to be effective by a small body of literature in adults with acquired neurological impairments when provided three times per week for 8 weeks. In patients with unilateral limb weakness secondary to stroke, aquatic exercises were shown to improve aerobic capacity, gait speed, strength of the paretic limb, and balance (Chu et al., 2004, [2a]; Noh, Lim, Shin, & Paik, 2008, [2b]). Aquatic therapy/exercise has also been shown to improve endurance, strength, body composition, muscle tone/muscle spasm severity, functional abilities, and gait in patients with spinal cord injury

(Broach, Groff, & Dattilo, 1997, [4b]; Kesiktas et al., 2004, [2b]; Real da Silva, Jaco de Oliveira, & Conceicao, 2005, [2b]; Stowell, Fuller, & Fulk, 2001, [5a]; Zamparo & Pagliaro, 1998, [2b]). In adults with acquired brain injury aquatic exercise has been shown to improve ROM, ataxia, balance, gait, flexibility, strength, body composition, endurance, affect, self esteem, health promoting behaviors, and mood (Degano & Geigle, 2009, [5a]; Driver, Lox, O'Connor, & Rees, 2003, [4b]; Driver, O'Connor, Lox, & Rees, 2004, [2b]; Driver, Rees, O'Connor, & Lox, 2006, [2b]; Driver & Ede, 2009, [2a]). The results from these studies are limited, however, due to non-randomization, small sample sizes, and lack of long term follow up.

Aquatic physical therapy combined with land physical therapy versus land physical therapy alone has been studied in few select populations such as those with juvenile idiopathic arthritis, cerebral palsy, total knee arthroplasty, and developmental delay.(Epps et al., 2005, [2b]; Hutzler, Chacham, Bergman, & Szeinberg, 1998, [2b]; McAvoy, 2009, [2a]; McManus & Kotelchuck, 2007, [4a]). Aquatics combined with land-based therapy has shown to be more effective in improving disease state (Epps et al., 2005, [2b]), functional skills (McAvoy, 2009, [2a]), quality of life (Epps et al., 2005, [2b]), cardiovascular fitness (Epps et al., 2005, [2b]), vital capacity (Hutzler et al., 1998, [2b]), range of motion (McAvoy, 2009, [2a]), and gross motor skills (McManus & Kotelchuck, 2007, [4a]) over land based physical therapy alone in these populations.

Results from the above mentioned studies cannot be generalized to children with acquired neurologic impairments based on the age of the participants, mechanism of healing, goals of rehabilitation, low methodological quality of studies, and varied outcome measures used to assess dependent variables. It is difficult to generalize from adults to children secondary to the effects of growth and maturation on development. The mechanism of healing in patients with acquired neurological impairments involves spontaneous recovery and differs greatly from those patients with orthopedic, developmental, or non-acquired neuromuscular conditions. The goals of therapy also differ in that patients with acquired neurologic impairments focus on returning to prior levels of function rather than developing new skills that were not yet achieved. All of these factors lead to the conclusion that there is insufficient evidence in order to make a recommendation regarding the use of aquatic physical therapy combined with land-based physical therapy in improving functional independence of children with acquired neurological impairments.

Implications/Directions for Future Research

It would be helpful if studies on the differences between aquatic therapy and land based therapy could determine what frequency and duration provide the best outcomes. Future studies should utilize standardized outcome measures to assess functional independence including: The Gross Motor Function Measure, The Pediatric Evaluation of Disability Inventory, The Canadian Occupational Performance Measure, The Functional Independence Measure, and The Mayo-Portland Adaptability Inventory 4.

Health Benefits, Side Effects and Risks

The potential benefits of aquatic physical therapy in children and adults are numerous and include increased flexibility, muscle endurance, and muscle strength; improved circulatory function and cardiovascular status; pain reduction; improved coordination and balance; reduction in muscle tone; improved head and trunk stability; increased kinesthetic sense/body awareness; and psychological benefits (Ruoti et al., 1997, [5]). In addition study participants reported that they enjoyed participating in an aquatic program and would like to continue swimming beyond the research study (Broach et al., 1997, [4b]).

Side effects of aquatic treatment were not reported in the literature. Potential side effects may include fatigue, dehydration, and increased soreness following aquatic intervention.

The risks associated with aquatic physical therapy treatment are minimal and may include water hazards such as chemical sensitivity, reaction to climate, falls and drowning.

References (evidence grade in []; see Table of Evidence Levels following references)

- Broach, E., Groff, D., & Dattilo, J. (1997). Effects of an aquatic therapy swimming program on adults with spinal cord injuries. *Therapeutic Recreation Journal*, 31(3), 160-173. [4b]
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- Degano, A. C., & Geigle, P. R. (2009). Use of aquatic physical therapy in the treatment of balance and gait impairments following traumatic brain injury: A case report. *Journal of Aquatic Physical Therapy*, 17, 16-21. [5a]
- Driver, S., & Ede, A. (2009). Impact of physical activity on mood after TBI. *Brain Injury*, 23, 203-212. [2a]
- Driver, S., Lox, C., O'Connor, J., & Rees, K. (2003). Effect of an aquatics program on psycho/social experiences of individuals with brain injuries: A pilot study. *The Journal of Cognitive Rehabilitation*, 21, 22-31. [4b]
- Driver, S., O'Connor, J., Lox, C., & Rees, K. (2004). Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. *Brain Injury*, 18, 847-859. [2b]
- Driver, S., Rees, K., O'Connor, J., & Lox, C. (2006). Aquatics, health-promoting self-care behaviours and adults with brain injuries. *Brain Injury*, 20, 133-141. [2b]
- Epps, H., Ginnelly, L., Utley, M., Southwood, T., Gallivan, S., Sculpher, M., & Woo, P. (2005). Is hydrotherapy cost-effective? A randomised controlled trial of combined hydrotherapy programmes compared with physiotherapy land techniques in children with juvenile idiopathic arthritis. *Health Technology Assessment*, 9(39), 1-59. [2b]
- Hutzler, Y., Chacham, A., Bergman, U., & Szeinberg, A. (1998). Effects of a movement and swimming program on vital capacity and water orientation skills of children with cerebral palsy. *Developmental Medicine and Child Neurology*, 40, 176-181. [2b]
- Kesiktas, N., Paker, N., Erdogan, N., Gulsen, G., Bicki, D., & Yilmaz, H. (2004). The use of hydrotherapy for the management of spasticity. *Neurorehabilitation and Neural Repair*, 18(4), 268-273. [2b]
- McAvoy, R. (2009). Aquatic and land based therapy vs. land therapy on the outcome of total knee arthroplasty: A pilot randomized clinical trial. *The Journal of Aquatic Physical Therapy*, 17(1), 8-15. [2a]
- McManus, B. M., & Kotelchuck, M. (2007). The effect of aquatic therapy on functional mobility of infants and toddlers in early intervention. *Pediatric Physical Therapy*, 19(4), 275-282. [4a]
- Noh, D. K., Lim, J., Shin, H., & Paik, N. (2008). The effect of aquatic therapy on postural balance and muscle strength in stroke survivors -- a randomized controlled pilot trial. *Clinical Rehabilitation*, 22(10-11), 966-976. [2b]

- Real da Silva, M., Jaco de Oliveira, R., & Conceicao, M. (2005). Effects of swimming on the functional independence of patients with spinal cord injury. *Revista Brasileira De Medicina do Esporte, 11(4)*, 237e-241e. [2b]
- Ruoti, R. G., Morris, D. M., & Cole, A. J. (1997). *Aquatic rehabilitation* (1st Edition ed.). Philadelphia: Lippincott Williams & Wilkins. [5]
- Stowell, T., Fuller, R., & Fulk, G. (2001). An aquatic and land-based physical therapy intervention to improve functional mobility for an individual after an incomplete C6 spinal cord lesion. *Journal of Aquatic Physical Therapy, 9*, 27-32. [5a]
- Zamparo, P., & Pagliaro, P. (1998). The energy cost of level walking before and after hydro-kinesi therapy in patients with spastic paresis. *Scandinavian Journal of Medicine & Science in Sports, 8(4)*, 222-228. [2b]

Note: Full tables of evidence grading system available in separate document:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (abbreviated table below)

Table of Evidence Levels (see note above)

<i>Quality level</i>	<i>Definition</i>
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

Table of Recommendation Strength (see note above)

<i>Strength</i>	<i>Definition</i>
“Strongly recommended”	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
“Recommended”	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.

Dimensions: In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.

1. Grade of the Body of Evidence (see note above)
2. Safety / Harm
3. Health benefit to patient (*direct benefit*)
4. Burden to patient of adherence to recommendation (*cost, hassle, discomfort, pain, motivation, ability to adhere, time*)
5. Cost-effectiveness to healthcare system (*balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis*)
6. Directness (*the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome]*)
7. Impact on morbidity/mortality or quality of life

Supporting information

Introductory/background information

The clinical question was derived from noting variations in the standard of care by physical therapists when performing aquatic therapy with patients with neurological impairments. This project was begun to improve consistency of care, to determine a protocol for a model of care with patients who have acquired neurological impairments and utilize aquatics, to improve the flow of patients through outpatient rehabilitation, to improve patient and family satisfaction, and to potentially decrease costs to the patients and increase revenue for the hospital.

Group/team members

Group/Team Leader: Heather Blackburn, PT, MPT, CBIS, Division of Occupational Therapy, Physical Therapy, and Therapeutic Recreation

Support personnel: Barbara Giambra, MS, RN, CPNP Evidence-Based Practice Mentor, Center for Professional Excellence/Research and Evidence-Based Practice

Search strategy

- **Date Range:** 1950 to October 2010
- **Keywords:** Aquatic therapy, aquatic exercises, hydrotherapy, aquatics, pool therapy, swimming, pediatrics, child, brain tumor, brain injury, encephalitis, spinal cord injury, meningitis, transverse myelitis, Guillan Barre, stroke, CVA, functional independence
- **Databases:** CINAHL, Medline, Pubmed, PEDro, Cochrane Library, Scopus, ACP Journal Club, Hooked on Evidence, PsychInfo, ERIC

Applicability issues

Standardized outcome measures should be used to assess functional independence when using either land-based or aquatic physical therapy including those such as: The Gross Motor Function Measure, The Pediatric Evaluation of Disability Inventory, The Canadian Occupational Performance Measure, The Functional Independence Measure, and The Mayo-Portland Adaptability Inventory 4.

Copies of this Best Evidence Statement (BEST) are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address: <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm>

Examples of approved uses of the BEST include the following:

- copies may be provided to anyone involved in the organization's process for developing and implementing evidence based care;
- hyperlinks to the CCHMC website may be placed on the organization's website;
- the BEST may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at HPCEInfo@cchmc.org for any BEST adopted, adapted, implemented or hyperlinked by the organization is appreciated.

This Best Evidence Statement has been reviewed against quality criteria by 2 independent reviewers from the Cincinnati Children's Hospital Medical Center (CCHMC) Evidence Collaboration.

For more information about CCHMC Best Evidence Statements and the development process, contact the Division of Occupational Therapy and Physical Therapy Office at: 513-636-4651.

Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.