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The effect of hydrotherapy on the functioning and quality of life of children and young adults with cerebral palsy

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Abstract

Background: Cerebral palsy (CP) is the most common cause of paralysis in infancy and childhood. There is evidence that the integration of hydrotherapy in the treatment program can significantly contribute to the rehabilitation of children and young people with CP by improving their functional limitations and overall, their quality of life. The purpose of this review was to present recent research data on the contribution and efficacy of hydrotherapy in the rehabilitation of children and young adults with CP. The Google Scholar and PubMed databases were searched with the following keywords: cerebral palsy, hydrotherapy, rehabilitation. This review included 11 articles. The results of our research show that hydrotherapy, both as an individual treatment and in combination with a standard land-based exercise program, can significantly contribute to the improvement of gross mobility, the improvement of exercise endurance and the improvement of the quality of life of people with CP. Ideal dosage of hydrotherapy programs, according to the research included in the review is 2-3 sessions per week for more than six weeks. However, it should be noted that the literature is still limited and further research is needed.

Keywords: cerebral palsy, hydrotherapy, rehabilitation

Introduction

Cerebral palsy (CP) is a neurodevelopmental disorder that is the most common cause of paralysis in infancy and childhood. It is usually diagnosed after the first three to five years of life. The etiology is multifactorial, but is usually due to an injury to the brain before, during birth or during the first months of life. Other causes can be premature birth, intrauterine or neonatal infections, multiple births and stroke^[1]. It is characterized by disorders of posture, movement and muscle tone, while it may be accompanied by other comorbidities, such as disorders of sensation, perception and communication, as well as epilepsy or secondary musculoskeletal problems^[2].

The prevalence of CP is estimated at 2-2.5 per 1000 live births^[2]. That is, in the last 20 years, in the western world, one in 400 children are born with CP, while life expectancy ranges between 30 and 70 years^[2, 3]. The prevalence and causes of CP differ geographically, based on the development of pediatric care (prenatal, intrapartum, postnatal). Typically, in developed countries, the main causes are premature births and extremely low birth weight babies, while in developing countries, prenatal erythema, endogenous asphyxia and postnatal hyperbilirubinemia^[1].

Hydrotherapy is characterized by the internal and external use of water, in any of its forms (liquid, solid and gaseous) for the treatment and rehabilitation of patients^[4]. Depending on temperature, duration, location and pressure, it produces different stimuli in different systems of the body and, according to the literature, is widely used to improve immunity, restore pain, cardiovascular and respiratory function and deal with fatigue, obesity, stress and anxiety^[4]. It is one of the most popular methods of complementary therapies for people with CP and its advantages are found in the buoyancy of water and the reduction of gravity, thus easing the compression in the joints and allowing easier and more active exercises. It can also improve endurance to multiple sensory stimuli and reduce muscle spasm^[5].

The aim of this review is to present recent research data on the contribution of hydrotherapy to the rehabilitation of people with CP.

Literature review

The Google Scholar and PubMed databases were searched with the following keywords: cerebral palsy, hydrotherapy, rehabilitation. This work included 11 articles (clinical studies, systematic reviews, semi-experimental design studies and pilot studies). The following are the main findings of the research included in this review.

In their study, Adar *et al.* [6] compared the efficacy of water exercise and land-based exercise on spasticity, motor function and quality of life in children with CP. The sample was 32 children, who were randomly divided into two groups (group with exercises in the water and group with exercises on land). Both programs lasted six weeks with five sessions per week, (total 30 sessions). Impairment level, functional measures, quality of life and the level of spasticity of the gastrocnemius were evaluated before and after the intervention. The results showed that the exercises in the water had the same efficacy as the exercises on land in terms of impairment level and functional measures, but no differences were found between the two groups. In contrast, regarding the self-perceived quality of life and the level of spasticity of the gastrocnemius, the individuals in the hydrotherapy group showed a higher score with a statistically significant difference after the intervention compared to the individuals in the land-based exercise group. The researchers found that water exercises were just as effective as land-based exercises in managing spasticity and improving motor function in children with CP.

Furthermore, Roostaei *et al.* [7] studied the effect of hydrotherapy on gross motor skills in children with CP. Their systematic review included 11 studies, most of which reported improvement in gross mobility, without side effects, after aquatic programs of 6-16 weeks with 2-3 sessions per week. The researchers found that according to existing research, exercise in the aquatic environment is beneficial and has minimal side effects. However, before exercise in the water is included in the treatment plan, therapists should take into account the functional abilities and weaknesses of the children, as well as the preferences of themselves and their parents.

Additionally on the subject of gross motor skills, Akinola *et al.* [8] also studied the effect of a hydrotherapy program on the gross mobility of children with spastic type CP. The study involved 30 children with CP, who were randomly divided into two groups. The first group performed passive stretching and functional exercises in the water while the other performed exercises on land. Both programs lasted 10 weeks, with each session lasting about one hour and 40 minutes, twice a week. Gross mobility was assessed before, during, and after the intervention. The results showed that the intervention group showed a significant improvement in all parameters of gross mobility, except walking, running and jumping, compared to the control group. The authors concluded that the application of exercises in water is more effective than land-based exercises in improving the gross mobility of children with CP.

Fragala-Pinkham *et al.* [9] conducted a pilot study to evaluate the efficacy of a 14-week hydrotherapy program on gross mobility and gait resistance in eight children (6-15 years old) with spastic CP. In addition, they wanted to evaluate changes in range of motion, aerobic capacity and balance. At the end of the intervention, significant improvements were observed in all parameters, especially in gross mobility and gait endurance. These measurements

were maintained during the follow-up measurement that took place one month later. The researchers concluded that children with CP who attend a hydrotherapy program for 14 weeks, with two sessions per week, and follow moderate to vigorous exercise and functional activities, will notice an improvement in their gross motor skills and gait endurance. In another study, Depiazzi *et al.* [10] conducted a randomized controlled trial to study the effect of a high-intensity interval training (HIIT) aquatic program on adolescents with CP who move independently but may, at times, choose an aid. The study involved 12 participants, who were randomized into two equal groups, one following a conventional exercise program and the other a HIIT program in the water. In the HIIT program, each session included 10 one-minute exercises, achieving $\geq 80\%$ of maximal heart rate (HRmax), with a one-minute pause after each exercise. After completing the study, the researchers concluded that the HIIT program in the water was effective for adolescents, with no significant side effects or worsening of pain. However, due to the small sample number and the heterogeneity of the participants, they could not come to safe conclusions regarding the superiority of HIIT in relation to the conventional physiotherapy program. Finally, the participants mentioned that the intervention was fun and that they would like to continue this program mainly because it provided opportunities for socialization.

Moreover, Muñoz-Blanco *et al.* [11] conducted a qualitative study in order to describe the experiences of children and young people with CP from their participation in a hydrotherapy program in a special education school, while examining their therapeutic and educational perspectives. The study involved 27 people, and the sample consisted of children and young people with CP (who underwent hydrotherapy for more than a year), their parents, special education teachers and health professionals. The results showed that the hydrotherapy sessions were beneficial for the children as they caused them feelings of joy and calm, while encouraging them to participate in further activities. Improvement in posture and coordination of movements due to muscle adjustments from exercise was also observed. Professionals added that the program encouraged children to explore their potential in their educational, therapeutic and family environment. Therefore, the researchers argued that conducting similar programs in a controlled environment, such as special education schools and not only for people with CP, but also for other pathologies, with the participation of the family has many benefits for these children.

The effects of a hydrotherapy program on children with spastic CP, in terms of motor function, exercise enjoyment, daily activities and quality of life was the study focus of Lai *et al.* [102]. Two groups were formed. The first group (intervention group, 11 children) followed a conventional treatment program on land in combination with a hydrotherapy program. The second group (control group, 13 children) followed exclusively the conventional program on land. This intervention lasted 12 weeks, with the first group performing along with their conventional land-based treatment program two hydrotherapy sessions of 60 minutes per week, while the other group performed 2-3 sessions for 30 minutes. At the end of the study, it was observed that children who followed the hydrotherapy program saw, on average, a greater improvement in their mobility, compared to the control group, while, at the same time, they enjoyed

the exercise more. Regarding the other measurements, there was no significant difference between the two groups, nor was there any improvement in one program compared to the other in terms of muscle tone. As a result, the researchers concluded that adding hydrotherapy to a land-based exercise program in children with CP is safe, effective and at the same time makes the therapeutic exercise program more enjoyable.

Ballaz *et al.* [13] studied the effect of a 10-week hydrotherapy program on adolescents with CP to improve gait. In addition, they wanted to evaluate the optimal intensity of exercise during the program. A total of 20 sessions were held, twice a week, for 45 minutes at a time. At the end of the intervention, there was a significant improvement in gait, with moderate exercise intensity on average (mild to moderate for more than half of the session) while cardiovascular adjustments were observed (significant reduction in heart rate during exercise after program). According to the results of this study, a group hydrotherapy program is beneficial for adolescents with CP, as it improves the performance of participants in walking and leads to cardiorespiratory adjustments during exercise.

The study of Kim and Shin [14] investigated the effect of hydrotherapy in children with spastic CP. Participants were 20 children with CP (aged 3-7 years), who attended a 40-minute weekly hydrotherapy session for eight weeks. Particular emphasis was placed on lower limb mobility exercises. At the end of the intervention, a significant improvement was observed in the static balance from the sitting position, in the dynamic balance from the sitting position and the dynamic approach of objects from the sitting position. Significant improvement was also observed in body weight distribution. The researchers concluded that the implementation of a hydrotherapy program in children with spastic CP is beneficial in improving orthostatic control and balance.

In their study, Declerck *et al.* [15] explored the benefits and fun that swimming can bring to children with CP. The study involved 14 children (7-17 years old), who were randomized in the intervention group (seven children) and in the control group (seven children), with the first group following a 10-week swimming program, with sessions two times per week (40-50 minutes). The researchers observed a significant improvement in the gait of the participants in the swimming group compared to the participants in the control group and an increase in the level of fun, while at the same time the pain and fatigue did not increase. The follow-up that was implemented after 20 weeks confirmed that the improvement in walking and swimming was maintained. The researchers concluded that a swimming program is ideal to complement a physiotherapy program in children with CP.

Lastly, Ballington and Naidoo [16] studied the subsequent effect of a water treatment program on children with CP, in terms of their orthostatic control and balance in activities such as walking, running and jumping. The study involved 10 children (8-12 years old), who were divided into two groups (intervention and control). The intervention group participated in 30-minute sessions, twice a week, while the control group continued with standard land-based activities. This program lasted a total of eight weeks, with the gross mobility of the children being assessed before and after the intervention. The group that followed the hydrotherapy program showed increased motor function compared to the

control group, while at the same time the average performance of gross mobility improved. Therefore, the researchers argue that hydrotherapy should be integrated into the treatment program, along with other conventional techniques, to ensure long-term improvement in gross mobility.

Discussion – Conclusions

It can be derived from the above research that the contribution of hydrotherapy to the rehabilitation of children and young people with CP, both physically and psychologically, is important. Properties of water, such as buoyancy, facilitate the exercise without pain, as in relation to the exercise programs on land, the friction of the joints and the risk of falls are reduced.

The results showed a significant improvement in gross mobility and more specifically the quality and distance of gait and static standing position [6-10, 14]. There was also an improvement in the cardiorespiratory system in endurance, balance, fluidity of movement and range of motion [9]. Management of spasticity showed improvement, but to a lesser extent, as did muscle strength [6-11].

The improvement of the psychological condition of these children as well as their social skills, with special emphasis on their willingness to participate in activities, in family, therapeutic and school context was also noted [11].

Some of the studies implemented a follow-up, during which it seemed that the results were maintained, to some extent, even after the therapeutic intervention [15].

The results of this review show that hydrotherapy, both when applied individually and in combination with a conventional exercise program, can significantly contribute to the improvement of gross mobility, exercise endurance and quality of life of people with CP. It should also be noted that the literature on the effect of hydrotherapy in children with CP is still limited. Therefore, further research is needed to determine the efficacy of this method on gross motor skills and the appropriate dosage based on age.

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