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hypoxic- ischemic insult leads to cellular necrosis, neuronal inactivation and cerebral white matter injury are the most common causes of severe neurological handicaps in children with CP (Efrati and Ben- Jacob, 2014).

Children with cerebral palsy typically receive physiotherapy therapy to facilitate motor development and to enhance their independence in motor skills, Self- care, play, and leisure activities. Over the years, many systems of treatment have been developed that differ in their specific treatment strategies, but aim to lead children with cerebral palsy toward the greatest degree of independence possible.

In our study, as regards the age, there was no statistical significant difference between the mean value of the 4 studied groups A, B, C& D Which was 5.90± 1.16, 5.90± 1.20, 5.90± 1.20, and 5.90± 1.20 years respectively.

In our study, as regards the gender, there was no statistical significant difference between the percentages of the 4 studied groups. Group A was 12 (40%) female and 18 (60%) male, Group B was 4 (40%) female and 6 (60%) male, Group C was 5 (50%) female and 5 (50%) male and Group D was 6 (60%) female and 4 (40%) male.

In our study, there was no statistical significant difference pre treatment between the 4 studied groups A, B, C& D regarding Gait Parameters (Step length, Stride length, Step width, and Foot progression angle) and Modified Ashworth Scale.

In group A (Control) there was statistical significant improvement in gait parameters and Modified Ashworth scale. There was high statistical significant difference between pre and post treatment regarding Step length, Stride length, Step width, Foot progression angle and Modified Ashworth scale.

In group B there was statistical significant improvement in gait parameters. There was high statistical significant difference between pre and post treatment regarding Step length, Stride length, Step width and Modified Ashworth scale.

In group C there was statistical significant improvement in gait parameters. There was high statistical significant difference between pre and post treatment regarding Stride length, Step width, Foot progression angle.

In group D there was statistical significant improvement in gait parameters. There was high statistical significant difference between pre and post treatment regarding Step length, Stride length, Step width, and Foot progression angle.

In our study, In Comparison between the post treatment of studied groups A, B, C, and D according to Step length there was more improvement in groups Band C.

In our study, In Comparison between the post treatment of studied groups A, B, C, and D according to Stride length there was more improvement in group B.

In our study, In Comparison between the post treatment of studied groups A, B, C, and D according to Step width there was more improvement in group B.

In our study, In Comparison between the post treatment of studied groups A, B, C, and D according to Foot progression angle there was more improvement in group B.

In our study, there was no statistical significant difference post treatment between the 4 studied groups A, B, C& D regarding Modified Ashworth Scale. There was more improvement in groups A and B.

In agreement of our study, hyperbaric oxygen therapy (HBOT) is an interesting therapeutic modality defined as the use of oxygen at greater than atmospheric pressure as a drug to treat basic pathophysiologic processes and the associated diseases (Lacey et.al., 2012).

As HBOT can initiate vascular repair and improve cerebral vascular flow, induce regeneration of axonal white matter, stimulate axonal growth, promote blood- brain barrier integrity and reduce inflammatory reactions as well as brain edema (Huang and Obenaus, 2011).

At the cellular level, HBOT can improve cellular metabolism, reduce apoptosis, relieve oxidative stress and increase levels of neurotrophins and nitric oxide through improving mitochondrial function in both neurons and glial cells and may even promote neurogenesis of endogenous neural stem cells (Lin et.al., 2012).

Efrati and Ben- Jacob (2014), who mentioned that some weeks would be necessary for brain tissue regeneration and angiogenesis and they also reported that the brain of the child with cerebral palsy suffered from neurological insult since birth, so it would take time for the brain repair to become clinically apparent.

The sooner the ozone therapy is started the better, because there is no hope of reviving dead neurons. Controlled administration of ozone can be helpful (Bocci, 2007).

Acupuncture treatment for cerebral palsy is still considered relatively new. Only a few in- depth studies have been done, but the results so far have been positive. (Neoh Choo et.al., 2017).

Western medical science so far has not found a proven explanation for the success of Chinese scalp acupuncture in treating central nervous system disorders and specifically with treating cerebral palsy. There is a growing amount of clinical evidence that scalp acupuncture can improve or remove symptoms in patients with cerebral palsy (Lin et.al., 2012).

Conclusion:

1. Hyperbaric oxygen therapy HBOT have the best results in this study followed by ozone followed by acupuncture.

2. Physiotherapy (PT) and occupational therapy (OT) are very important methods in management of children with cerebral palsy.

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Ethical issues:

Written informed consents were obtained from parents after explanation of the aim of the study and its benefits for their children.

Data Analysis:

The data obtained was statistically analyzed. The mean and standard deviation were calculated for each variable, for all groups A, B, C and D before and after the application of management programs.

Results:

Table (1) Comparison between the studied groups A& B according to Gait Parameters and Modified Ashworth Scale after applying protocols

		Group A	Group B	Test Value	P- Value	Sig.
		No. = 30	No. = 30			
Step Length Post	Mean± SD	25.25± 1.14	26.55± 1.01	- 3.198	0.003	HS
	Range	23.5- 27	25.5- 28			
Stride Length Post	Mean± SD	55.00± 1.35	56.25± 1.36	- 2.538	0.015	S
	Range	53- 57	54.5- 58.5			
Step Width Post	Mean± SD	10.75± 0.83	10.45± 0.76	1.011	0.318	NS
	Range	9.5- 12	9.5- 12			
Foot Progression Angle Post	Mean± SD	16.17± 0.97	14.37± 0.70	5.395	0.000	HS
	Range	15- 17.5	13- 15.5			
Modified Ashworth Scale Post	1	9 (30%)	4 (40%)	0.659	0.719	NS
	1+	15 (50%)	5 (50%)			
	2	6 (20%)	1 (10%)			

Table (2) Comparison between the studied groups A& C according to Gait Parameters and Modified Ashworth Scale after applying protocols

		Group A	Group C	Test Value	P- Value	Sig.
		No. = 30	No. = 30			
Step Length Post	Mean± SD	25.25± 1.14	26.55± 2.83	- 2.092•	0.043	S
	Range	23.5- 27	23.5- 34			
Stride Length Post	Mean± SD	55.00± 1.35	55.15± 1.40	- 0.303•	0.764	NS
	Range	53- 57	53- 57			
Step Width Post	Mean± SD	10.75± 0.83	10.65± 0.82	0.332•	0.742	NS
	Range	9.5- 12	9.5- 12			
Foot Progression Angle Post	Mean± SD	16.17± 0.97	16.00± 0.94	0.483•	0.632	NS
	Range	15- 17.5	15- 17.5			
Modified Ashworth Scale Post	1	9 (30%)	2 (20%)	0.416*	0.812	NS
	1+	15 (50%)	6 (60%)			
	2	6 (20%)	2 (20%)			

Table (3) Comparison between the studied groups A& D according to Gait Parameters and Modified Ashworth Scale after applying protocols.

		Group A	Group D	Test Value	P- Value	Sig.
		No. = 30	No. = 30			
Step Length Post	Mean± SD	25.25± 1.14	25.60± 1.02	- 0.859•	0.396	NS
	Range	23.5- 27	24.5- 27.5			
Stride Length Post	Mean± SD	55.00± 1.35	55.41± 1.00	- 0.882•	0.383	NS
	Range	53- 57	54- 57.5			
Step Width Post	Mean± SD	10.75± 0.83	10.60± 0.77	0.504•	0.617	NS
	Range	9.5- 12	9.5- 11.5			
Foot Progression Angle Post	Mean± SD	16.17± 0.97	15.60± 0.93	1.625•	0.113	NS
	Range	15- 17.5	14.5- 17.2			
Modified Ashworth Scale Post	1	9 (30%)	3 (30%)	0.571*	0.751	NS
	1+	15 (50%)	6 (60%)			
	2	6 (20%)	1 (10%)			

Table (4) Comparison of the studied cases in group A pre and post applying protocols

		Group A		Test Value	P- Value	Sig.
		Pre	Post			
Step Length	Mean± SD	24.70± 1.21	25.25± 1.14	-19.746**	0.000	HS
	Range	23- 26.5	23.5- 27			
Stride Length	Mean± SD	54.35± 1.42	55.00± 1.35	- 7.779**	0.000	HS
	Range	51.5- 56	53- 57			
Step Width	Mean± SD	11.65± 0.72	10.75± 0.83	9.893**	0.000	HS
	Range	10.5- 12.5	9.5- 12			
Foot Progression Angle	Mean± SD	16.93± 1.08	16.17± 0.97	9.583**	0.000	HS
	Range	15.2- 18.4	15- 17.5			
Modified Ashworth Scale	1	0 (0%)	9 (30%)	11.273**	0.004	HS
	1+	18 (60%)	15 (50%)			
	2	12 (40%)	6 (20%)			

Table (5) Comparison of the studied cases in group B pre and post applying protocols

		Group B		Test Value	P- Value	Sig.
		Pre	Post			
Step Length	Mean± SD	24.70± 1.14	26.55± 1.01	- 12.333	0.000	HS
	Range	23- 26.5	25.5- 28			
Stride Length	Mean± SD	54.50± 0.82	56.25± 1.36	- 4.341	0.002	HS
	Range	53.5- 56	54.5- 58.5			
Step Width	Mean± SD	11.95± 0.50	10.45± 0.76	9.000	0.000	HS
	Range	11.5- 12.5	9.5- 12			
Foot Progression Angle	Mean± SD	15.36± 5.00	14.37± 0.70	0.572	0.582	NS
	Range	1.4- 18.4	13- 15.5			
Modified Ashworth Scale	1	0 (0%)	3 (30%)	11.273*	0.004	HS
	1+	6 (60%)	5 (50%)			
	2	4 (40%)	2(20%)			

Table (6) Comparison of the studied cases in group C pre and post applying protocols

		Group C		Test Value	P- Value	Sig.
.		Pre	Post			
Step Length	Mean± SD	24.75± 1.23	26.55± 2.83	- 1.751**	0.114	NS
	Range	23- 26.5	23.5- 34			
Stride Length	Mean± SD	54.35± 1.47	55.15± 1.40	- 7.236**	0.000	HS
	Range	51.5- 56	53- 57			
Step Width	Mean± SD	11.65± 0.75	10.65± 0.82	5.071**	0.001	HS
	Range	10.5- 12.5	9.5- 12			
Foot Progression Angle	Mean± SD	16.89± 1.14	16.00± 0.94	5.870**	0.000	HS
	Range	15.2- 18.4	15- 17.5			
Modified Ashworth Scale	1	0 (0%)	2 (20%)	3.377*	0.185	NS
	1+	5 (50%)	6 (60%)			
	2	5 (50%)	2 (20%)			

Table (7) Comparison of the studied cases in group D pre and post applying protocols.

		Group D		Test Value	P- Value	Sig.
		Pre	Post			
Step Length	Mean± SD	24.70± 1.14	25.60± 1.02	- 7.216**	0.000	HS
	Range	23- 26.5	24.5- 27.5			
Stride Length	Mean± SD	54.20± 0.79	55.41± 1.00	- 4.549**	0.001	HS
	Range	53.5- 56	54- 57.5			
Step Width	Mean± SD	11.65± 0.75	10.60± 0.77	6.034**	0.000	HS
	Range	10.5- 12.5	9.5- 11.5			
Foot Progression Angle	Mean± SD	17.13± 1.09	15.60± 0.93	4.915**	0.001	HS
	Range	15.2- 18.4	14.5- 17.2			
Modified Ashworth Scale	1	0 (0%)	3 (30%)	4.800**	0.091	NS
	1+	6 (60%)	6 (60%)			
	2	4 (40%)	1 (10%)			

Discussion:

CP is generally considered as a nonprogressive condition resulting from neurological injury in the antenatal or perinatal period. Perinatal

NS: Non significant; S: Significant; HS: Highly significant, *: Chi- square test; •: Independent t- test, **: paired t- test.

Introduction:

Cerebral palsy (CP) describes a group of permanent disorders of development, movement and posture, resulting in activity limitation. Cerebral palsy (CP) is a nonprogressive disease that presents as a disorder of motion and posture following brain injury during a period of development (Asl et.al., 2015).

Also, CP is generally considered as a nonprogressive condition resulting from neurological injury in the antenatal or perinatal period. Perinatal hypoxic ischemic insult leads to cellular necrosis, neuronal inactivation and cerebral white matter injury are the most common causes of severe neurological handicaps in children with CP (Efrati and Ben-Jacob, 2014).

Cerebral palsy (CP) is a very common neural system development disorder that can cause physical disability in human (Zheng et.al., 2012).

Cerebral palsy is a major health problem caused by brain damage during pregnancy, delivery, or the immediate postnatal period. Perinatal stroke, intraventricular hemorrhage, and asphyxia are the most common causes of neonatal brain damage. Periventricular white matter damage (Periventricular Leukomalacia) is the predominant form in premature infants and the most common antecedent of cerebral palsy (Titomanlio et.al., 2011).

Hyperbaric oxygenation therapy (HBOT) has shown promise in clinical trials and is sought by many parents of children with cerebral palsy (CP). Evidence from around the globe is now accumulating providing strong support for the use of hyperbaric oxygen therapy (HBOT) as an approach to the actual underlying problem in children with cerebral palsy- a technique which actually targets the abnormalities of brain function. The use of hyperbaric oxygen therapy in cerebral palsy offers an exciting new therapeutic approach for the treatment of cerebral palsy (Lin et.al., 2012).

Hyperbaric oxygen therapy (HBOT) is an interesting therapeutic modality defined as the use of oxygen at greater than atmospheric pressure as a drug to treat basic pathophysiologic processes and the associated diseases (Lacey et.al., 2012).

Acupuncture with or without conventional therapy may have benefit in children with CP (Dabbous et.al., 2016).

Scalp Acupuncture, also known as Neuroacupuncture, is a treatment based on knowledge of traditional acupuncture and neurology. It is done by inserting acupuncture needles into the loose areolar tissue layer of the scalp to stimulate the brain neurons of the underlying area. It's a very safe treatment, since underlying area. It's a very safe treatment, since the skull protects the brain and there are no organs in the scalp to injure it. Scalp Acupuncture works by stimulating the brain cells that are related to the impaired functions. The mechanism is three- fold: to 'wake- up' the brain cells that are not dead but lacking in proper functioning, to encourage recruitment of healthy brain cells to perform the lost function and to promote a healthy reintegration of the brain system. (Neoh Choo et.al., 2017).

Aims:

The aim of this study is to compare different protocols management in cerebral palsy rehabilitation.

Subjects And Methods:

Type of the study: comparative study to compare different protocols management in cerebral palsy.

Subjects:

The study included 120 patients with CP of both genders, between 4 and 8 years of age, attending the Special Needs Care Center of the Faculty of Postgraduate Childhood Studies, Ain Shams University. The available patient's records used to select the sample, as well as written informed consents were obtained from parents. All The children in all groups received the same specific designed physiotherapy (PT) and occupational therapy (OT) program.

The children were classified into 4 groups: Group A: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) as control group. Group B: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and hyperbaric oxygen therapy (HBOT). Group C: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and acupuncture. Group D: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and ozone. According to the protocol of each type of management.

Control Group: Who received a designed physiotherapy (PT) and occupational therapy (OT) program directed towards improving gait pattern and walking balance three times/ week for three hours/ day for eight successive weeks. The children in control group received a specific designed physiotherapy (PT) and occupational therapy (OT) program only. Study Groups: who received the same designed physiotherapy (PT) and occupational therapy (OT) program given to the control group in addition to the protocol of each type of management.

Inclusion Criteria:

1. Spastic Cerebral Palsy.
2. Ages between (4- 8) years.
3. Patients who signed the consent form.
4. The degree of spasticity ranged from grade 1+ to 2 according to Modified Ashworth Scale. (Bohannon, and Smith, 1987).
5. They were able to follow simple verbal commands or instructions in both evaluation and treatment procedures.

Exclusion Criteria:

1. Patients with any other co- morbid chronic illness.
2. Children with chronic illness affecting growth e.g. cardiac or renal disease.
3. Severe Mental Retardation.
4. Cerebral palsy with loss of vision or hearing loss.
5. History of Epilepsy.
6. Previously received any antispastic drugs and battox.

Comparative study of different treatment Methods of rehabilitation in cerebral palsy

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Summary

Background: Cerebral palsy is a major health problem caused by brain damage during pregnancy, delivery, or the immediate postnatal period. Cerebral palsy (CP) is generally considered as a nonprogressive condition. The goal of any treatment program for cerebral palsy is to maximize function and minimize the development of secondary problems.

Objective: The aim of this study is to compare different protocols management in cerebral palsy.

Subjects and Methods: The study included120 patients with CP of both genders, between 4 and 8 years of age, attending the Special Needs Care Center of the Faculty of Postgraduate Childhood Studies, Ain Shams University. The available patient's records used to select the sample, as well as written informed consents were obtained from parents. The children were classified into 4 groups. Group A: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) as control group. Group B: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and hyperbaric oxygen therapy (HBOT). Group C: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and acupuncture. Group D: Included 30 children with cerebral palsy who received physiotherapy (PT) and occupational therapy (OT) and ozone. According to the protocol of each type of management. All The children in all groups received the same specific designed physiotherapy (PT) and occupational therapy (OT) program.

Results: Physiotherapy (PT) and occupational therapy (OT) are very important methods in management of children with cerebral palsy, hyperbaric oxygen therapy HBOT have the best effect in management children with cerebral palsy CP more than other management protocols such as ozone and acupuncture.

Conclusion: Hyperbaric oxygen therapy HBOT have the best results in this study followed by ozone followed by acupuncture.

Keywords: Cerebral palsy, hyperbaric oxygen therapy, ozone, acupuncture

دراسة مقارنة للطرق المختلفة لعلاج الشلل الدماغى

الخلفية: الشلل الدماغى هو اضطراب تطور النظام العصبى ويمكن أن يسبب الإعاقة الجسدية فى الإنسان وهو مشكلة صحية كبيرة بسبب تلف فى الدماغ أثناء الحمل والولادة، أو فترة ما بعد الولادة مباشرة. تعتبر الولادة المبكرة ونقص الوزن عند الولادة أهم الأسباب التى تؤدى إلى حدوث الشلل الدماغى .والهدف من أى برنامج لعلاج الشلل الدماغى هو تحسين الوظيفة والحد من تطور المشاكل الثانوية، وبالتالى تأخير أو تفادى الحاجة للتدخل الجراحى. وبرنامج العلاج الفعال يقلل ليس فقط الحاجة لإجراء عملية جراحية، ولكن يعزز قدرة المريض لتوازن أفضل، والمشاركة فى الأنشطة مع الأقران. استخدام العلاج بالأكسجين تحت الضغط فى الشلل الدماغى يقدم نهجا علاجيا جديدا لعلاج الشلل الدماغى ويؤدى إلى حدوث تحسن فى وظيفة الحركة وكذلك الوخز بالإبر والعلاج بالاوزون بعدا من الأمور المبشرة.

الهدف: الهدف من هذه الدراسة هو دراسة مقارنة للطرق المختلفة لعلاج الشلل الدماغى.

الأهمية: ان الشلل الدماغى كان دائما معضلة للوالدين جنبا إلى جنب مع المتخصصين فى العلاج فى محاولة للوصول لأفضل طرق العلاج. علاقة الدراسة باهداف القسم الوصول لأفضل اداء ممكن للأطفال المصابين بالشلل الدماغى هو من أهم أهداف القسم. حيث تهدف هذة الدراسة إلى التحقق من نتائج بعض الأساليب الحديثة فى علاج الشلل الدماغى.

نوع الدراسة: دراسة مقارنة.

الفرضية: يعتبر استخدام العلاج بالأكسجين تحت الضغط العالى أفضل من الوخز بالإبر والعلاج بالاوزون فى علاج الشلل الدماغى.

المرضى: شملت الدراسة على ١٢٠ طفلا مصابا بالشلل الدماغى التقلصى من الذكور والإناث المتابعين فى العيادة الخارجية بمركز رعاية الأطفال ذوى الأحتياجات الخاصة بكلية الدراسات العليا للطفولة، جامعة عين شمس. قد استمرت فترة العلاج لمدة ٦ شهور تبعا للبروتوكول الخاص بكل نوع من انواع العلاج.

النتائج: استخدام الأوكسجين بالضغط العالى حقق أفضل النتائج يليه استخدام الاوزون ثم الوخز بالإبر، وان العلاج الطبيعى والعلاج الوظيفى مهم جدا فى علاج الأطفال المصابين بالشلل الدماغى.

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