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Literature review: Infantile cerebral palsy, causes, symptoms, diagnosis and treatment

Revisión bibliográfica: Parálisis cerebral infantil, causas, síntomas, diagnóstico y tratamiento

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ABSTRACT

Infantile cerebral palsy (ICP) is a non-progressive pediatric disease and the most frequent cause of childhood disability; it is a permanent motor impairment due to a non-evolutionary lesion of the central nervous system during the early period of brain development. The objective of this research was to obtain systematically updated information on the main characteristics of infantile cerebral palsy (CP), considering risk factors, symptoms, diagnosis and treatment. Thus, by means of a focused narrative-descriptive

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literature review, a compilation of publications in journals and scientific articles of academic interest was made, using inclusion and exclusion criteria. Thirty publications were selected from scientific articles and other documents. Subsequently, relevant information was analyzed, synthesized and discussed. It was determined that the global prevalence is between 1.5-3/1000 of live newborns, it is more frequent in products weighing 1000-1499 grams, in Latin America there are no data, since there are no studies or programs specialized in the subject. ICP presents multiple risk factors that interact giving effects in the fetus or newborn.

RESUMEN

La parálisis cerebral infantil (PCI) es una enfermedad pediátrica no progresiva y la causa más frecuente de discapacidad infantil, es una alteración de la motricidad permanente por lesión no evolutiva del sistema nervioso central, durante el periodo temprano de desarrollo cerebral. Esta investigación tuvo como objetivo obtener información actualizada sistemáticamente sobre las principales características de la Parálisis cerebral infantil (PCI), considerando factores de riesgo, síntomas, diagnóstico y tratamiento. Fue así, que mediante una revisión bibliográfica narrativa-descriptiva enfocada se realizó una recopilación de publicaciones en revistas y artículos científicos de interés académico, usando criterios de inclusión y exclusión. Se seleccionaron 30 publicaciones entre artículos científicos y otros documentos. Posteriormente, se analizó, sintetizó y discutió la información de relevancia. Se determinó que la prevalencia global se sitúa entre un 1,5-3/1000 de recién nacidos vivos, es más frecuente en productos de 1000-1499 gramos de peso, en Latinoamérica no se cuenta con datos, ya que no existen estudios o programas especializados en el tema. La PCI presenta múltiples factores de riesgo que interactúan dando efectos en el feto o recién nacido.

Keywords / Palabras clave

Cerebral palsy, infantile, non-progressive, risk factors, diagnosis, treatment

Parálisis cerebral infantil, no progresiva, factores de riesgo, diagnóstico, tratamiento

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Introduction

Infantile cerebral palsy (CP) is a very common pediatric disease that causes permanent and unanticipated physical disabilities in children due to injury or abnormalities in the brain at early stages of development. This manifests in varying degrees of mobility limitation from mild to severe spastic in all limbs. It cannot be considered as a single disease, as the symptoms are expressed differently in each individual (Villasís-Keever & Pineda-Leguízamo, 2017).

In addition, it is one of the 3 most common developmental disabilities that prevail throughout life, so it is also defined as a group of permanent developmental disorders of movement and posture, which cause limitations in activity and are attributed to non-progressive alterations occurring in the brain development of the fetus or infant (Espinoza Diaz et al., 2019).

ICH is a disease that is presumed to have accompanied humanity since its beginnings, with evidence in Egyptian mummies and stelae, being described in ancient Greece by Hippocrates (460-370 BC) and Soranus (98-138 AD), as well as in Rome by historians such as Suetonius (70-126 AD). (Ruiz Brunner & Cuestas, 2019).

ICP has been the subject of research in the contemporary era where the foundations of its definition and etiology have been laid, some antecedents emerged in France between 1820-1827, with reports of cerebral hemiatrophy that were related to hemiplegia in post mortem studies. However, in 1860 William Little, an English surgeon, offered for the first time a medical description of a disorder that affected children in the first years of life and that was characterized by muscular rigidity, showing difficulty in holding and grasping objects, as well as in crawling and walking. For a long time it was called "Little's disease", today it is known that this condition is spastic diplegia, one of the disorders that are encompassed under the term cerebral palsy. (Espinoza Diaz et al., 2019).

In 1897, Sigmund Freud discovered a disorder affecting brain development, which was sometimes accompanied by mental retardation, visual disturbances and seizures. In addition, he established risk factors that are still used today, which are congenital/prenatal and perinatal, which encompass 95% of ICH cases, along with acquired after birth (postnatal), which accounts for

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15% of ICH cases. (Espinoza Diaz et al., 2019; Manzanas Alonso, 2018).

In addition, ICP is usually accompanied by other comorbidities whose existence or absence can cause its diagnosis to be inaccurate. In general, they present affectations in perception, cognition, communication and behavior, due to epilepsy and secondary musculoskeletal problems; therefore, it is considered as the most frequent cause of motor disability in the pediatric age and the second cause of severe mental retardation. (Coronados Valladares et al., 2021; Rodríguez Mariblanca & Cano de la Cuerda, 2021).

So it is considered as a public health problem that is characterized by hindering the transmission of messages sent by the brain to the muscles, being its worldwide incidence of 2 to 2.5 cases per 1000 live newborns (NB) which has been maintained (Manzanas Alonso, 2018). It is worth mentioning that despite improvements in obstetrics and neonatology that have reduced the condition in term newborns, the overall incidence of ICH has increased since the 1980s due to the growth in survival preterm products of 1500 grams. The age limit after delivery is debated, but it is accepted up to 2 years of life. 66(Rodríguez Mariblanca & Cano de la Cuerda, 2021).

The most common cause of PCI is a deficit of blood supply to a developing brain due to hemorrhage, inflammation or stroke. The patterns of ICP can be classified according to the type of predominant motor disorder in spastic or pyramidal in children, this variety covering 75-80% of cases usually occurs when the nerve cells of the outer layer of the brain or cortex, does not function properly, can be congenital or acquired, and can be dyskinetic, extrapyramidal or mixed pattern. (Villasís-Keever & Pineda-Leguízamo, 2017). It can also be classified topographically according to the damaged area of the brain, such as parasagittal brain injury, periventricular leukomalacia, focal and multifocal ischemic brain necrosis, stratum marmorum and selective neuronal necrosis.

It is worth mentioning that prematurity is not only a primary component in the death of the child, but also causes other adverse events, such as neurodevelopmental alterations, any injury that occurs in the brain of the premature newborn will compromise a critical time of its development, since the immature brain undergoes a period of active myelination. (Fernandez Sierra, 2017). Currently, there is no cure for this condition, being managed with a

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multidisciplinary approach with the aim of providing the maximum degree of functional independence to the patient.

Therefore, the aim of this literature review article is to obtain updated information in a systematic way and to summarize what Infantile Cerebral Palsy is about, obtaining information about risk factors, symptoms, diagnosis and treatment, being a contribution to the scientific community and physicians for a correct management of the disease.

Materials and Methods

For the following documentary research, a narrative-descriptive bibliographic review was applied, focused on a compilation of publications in journals and scientific articles of academic interest that have been made regarding the topic of study, to later analyze them, synthesize them and discuss the relevant information published, thus achieving the collection of specific information. Therefore, the aim is to apply a comprehensive and critical reading, being of vital importance to describe the most relevant of each article and thus punctuate the ideas expressed in this paper.

Since this is a narrative review, there is no regulation on how to obtain primary data and how to integrate the results, what prevails is the subjective criterion of the reviewer. Thus, we have opted for obtaining scientific articles, degree works, among others, that allow us to gather influential information on the search topic, such documents will be obtained from Google Scholar, since it is a search engine that allows obtaining scientific documents.

A search of scientific documents was applied, for which the title of this document was written in both Spanish and English, then key words were used such as: cerebral palsy, infantile cerebral palsy, epidemiology of cerebral palsy Latin America, treatment of cerebral palsy, diagnosis of cerebral palsy, cerebral palsy in Ecuador, cerebral palsy, infantile cerebral palsy, epidemiology of cerebral palsy Latin America, treatment of cerebral palsy, diagnosis of cerebral palsy, epidemiological update of cerebral palsy, cerebral palsy in Ecuador.

The inclusion criteria of the articles were: The year of publication, which cannot be less than 5 years, since the aim is to obtain data that present updated information, even more so when searching for

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epidemiological data on the disease; in addition, studies were included that presented information in accordance with the search topic, whether these were bibliographic reviews and case studies that aimed to provide relevant theoretical data, such as concepts of influential terms in cerebral palsy. The exclusion criteria were articles older than 5 years and those that did not provide information on the subject of the study.

A number of 65 articles were obtained from which the abstract was reviewed, discarding 15 of them, then a critical reading of the complete document was applied to the remaining 50 articles, finally obtaining 30 articles, which may allow to meet the objective set by acquiring information on cerebral palsy.

The bibliographic review has five sub-sections: the first is dedicated to a brief conceptualization of infantile cerebral palsy, the second to bibliographic information, the second to its classification, the third to information on its epidemiology, the fourth to the epidemiology of cerebral palsy, and the fourth to the most common causes of cerebral palsy.

risk factors, the quito has information on the possible diagnosis that the health professional can take into consideration and allow him to be able to practice a treatment, which leads to the sixth and last section that contemplates the possible treatments.

Results

For the present bibliographic research, an initial search was carried out for.

The second filter was applied using the equation "infantile cerebral palsy", which yielded approximately 13,560 matches. Therefore, a second filter was applied using the search equation "epidemiological characteristics of cerebral palsy", yielding 6,540 results. In order to reduce the number of documents, exclusion criteria were used according to the period of time, i.e., not exceeding the previous 5 years, obtaining 65 documents, from which those not related to the title, abstract, date and that were not relevant to the topic were excluded, resulting in 50 documents. Finally, after a critical reading, 30 documents were selected.

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Infantile cerebral palsy is a persistent disorder of movement and posture, caused by non-evolutionary injury to the central nervous system, during the early period of brain development, generally limited to the first 3 years of life (Enireb-García & Patiño-Zambrano, 2017). . The injury that causes the PCI is not progressive, its clinical manifestations may vary over time, due to the plasticity (capacity of functional and structural restructuring of the central nervous system, after an aggression) of the developing brain. This condition is common in the immature brain, so the clinical picture is not static, but its manifestations change as the brain matures. (Rodríguez Mariblanca & Cano de la Cuerda, 2021).

Traditional classifications of ICH are based on neurological substrates with physiological or topographical structuring as shown in Table 1.

However, one of the most widely accepted traditional classifications is the one proposed by the Cerebral Palsy Surveillance Project in Europe (SCPE) as shown in Figure 2, with the types of ICH being the following:

Spastic cerebral palsy "Hypertonic".

It is one of the most common pathologies, with an incidence between 70-80%. It develops as a consequence of a dysfunction in the nerve cells of the cerebral cortex, either congenital or acquired. This lesion usually occurs during the brain development stage between 28 and 34 weeks of gestation, especially in the periventricular white matter which is very vulnerable to oxygen deprivation due to poor irrigation. The most common symptoms are excessive muscle stiffness and uncoordinated and involuntary movements, particularly in the arms, legs and back.

Figure 2. PC classification

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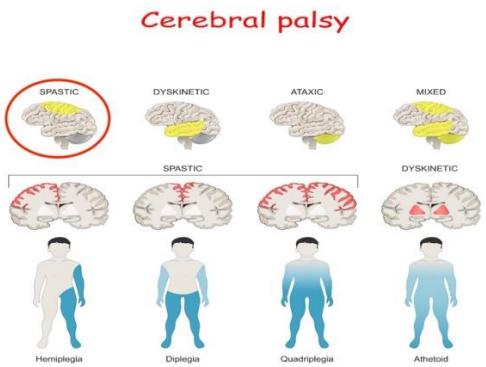

Table 1: *Traditional classifications of infantile cerebral palsy*

American Academy of Cerebral Palsy (1956)	Swedish classification (1989)	Edinburgh Classification (1996)	SCPE Classification (2000)
-Physiological (motor) -Spastica -Atetósica -Rigid -Ataxic -Tremor -Atonic -Mixta -Not classifiable Topographic - Monoplegia -Paraplegia -Hemiplegia -Triplegia - Quadriplegia Double hemiplegia - Diplegia Double hemiplegia	-Spastica -Hemiplegic -Tetraplegic -Diplegic -Dyskinetics -Distonic -Atetósica -Ataxic -Not classifiable/mixed	-Hemiplegia -Bilateral hemiplegia -Diplegia -Hypotonic -Distonic -Rigid -Spastica -Ataxic -Hypotonic or spastic diplegic -Ataxic -Dyskinetics -Distonic -Korea -Atetosis -Tremor -Other forms including the mixed	-Spastica -Bilateral -Unilateral - Diskinetics - Choreoathesis -Ataxic

Source: (Espinoza Diaz et al., 2019)

This disease is characterized by slow, unintentional and uncoordinated movements that hinder voluntary activity. It involves changes in muscle tone, ranging from hypertonicity to hypotonia. This causes problems with movement of the hands, arms, legs and feet, making it difficult to sit and walk. In some cases, it affects the

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facial muscles and tongue, making it difficult to articulate words. (Villasís-Keever & Pineda-Leguízamo, 2017).

Most cases of cerebral palsy are thought to be caused by congenital factors, with symptoms beginning to present when the person is one year old. Some of these causes are prenatal, familial or sporadic. People with cerebral ataxia have difficulty maintaining balance due to injury to the cerebellum. This may affect the person's ability to walk, depending on the severity of the injury. Mixed cerebral palsy

It occurs when the brain presents lesions in several of its structures. The most frequent is that they present a combination of some of the three previous types of ICH, especially spastic and dyskinetic (Villasís-Keever & Pineda-Leguízamo, 2017).

Other authors mention that it can also be classified according to the part of the body it affects, as shown in Figure 1, with a topographic classification described below:

- Paraplegia: Affection especially of the lower limbs.
- Hemiplegia: When one half of the body, either right or left, is affected by ICH, while the other half functions normally.
- Double tetraplegia-hemiplegia: Affects both arms and legs.
- Monoplegia: Affects one limb of the body.
- Diplegia: Affects two legs, but the arms are well or slightly affected.
- While according to the degree of involvement or severity that manifests cerebral palsy can be divided into:
- Severe: Lacks autonomy to perform all or almost all daily activities, depending on another person to perform them, a wheelchair or special equipment is necessary.
- Moderate: Needs help to perform certain activities and/or technical or orthopedic aids such as a cane.
- Mild: Can perform daily activities but in a clumsy way, being totally independent. (Manzanas Alonso, 2018).

Figure 1 Types of CP and areas of brain damage involved

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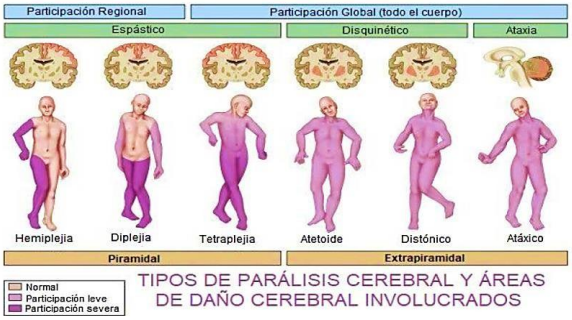

Source: (Peláez-Cantero et al., 2021).

The overall prevalence of ICH is around 1.5-3/1000 live newborns (LBW), and current studies have shown that this prevalence, currently estimated at 2.1 per 1000 LBW, is stable over the last 10 years, as reported in a systematic review and meta-analysis based on 19 studies that met rigorous methodological criteria. Furthermore, it is asserted that this prevalence has been stable during the last 10 years, as reported by a systematic review and meta-analysis based on 19 studies that met rigorous criteria in terms of methodology.

However, at eight years of age PCI can reach 3.3 per 1000 live births, due to the fact that in recent years there have been major changes in obstetric practice and newborn care such as fetal monitoring, emergency cesarean section, the emergence of neonatal intensive care units and especially specialized perinatal care, may perhaps be a factor for the increasing incidence of cases of PC in the world. (Coronados Valladares et al., 2021).. Thus, the prevalence is higher in premature newborns, being 40 to 100 per 1000 live births. It is more frequent in products of 1000-1499 grams of birth weight with 58.1 cases per 1000 NB and with gestational age less than 28 weeks being present the pathology in 111.8 cases per 1000 NB. (Escobar-Domingo & Becerra, 2019).

However, the congenital spastic variant is the most frequent with an estimated incidence in the United States of 1.7 per 1000 live births at one year of age, with the highest number of cases in low birth weights <1500 grams and in children under 32 weeks of gestation.

In the United States, the dyskinetic variant has an incidence of 0.14 cases per 1000 live births, 70% of which were the result of a term pregnancy. In this group, a higher number of neonatal seizures were recorded in the first 72 hours than in the bilateral spastic variant (Villasís-Keever & Pineda-Leguízamo, 2017).

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As for the ataxic variant, it is less frequent than the spastic and dyskinetic variants, and is estimated to occur in 3-8% of cases of PCI.

It is worth mentioning that in Latin America there is no joint epidemiological surveillance program for the evaluation of ICH and the studies carried out are scarce. It is difficult to obtain accurate statistics on ICH in Ecuador, however, it can be based on the few studies conducted, such as the one carried out in 127 children diagnosed with the disease in the Hospital de la Ciudad de Cuenca, which revealed that perinatal asphyxia was the main cause with a percentage of 77.2%, followed by postnatal factors with 13.4%, prenatal with 6.3% and genetic (malformations) with 3.1%. The data show that the most common clinical form was spastic with 84.7%, followed by dyskinetic with 6.9% and ataxic with 2.8%. In addition, 80.69% of the children had epilepsy, 75% presented cognitive deficits and 62.5% were malnourished (Villasís-Keever & Pineda-Leguízamo, 2017).

ICH has multiple causes, most often unknown. Multiple risk factors and external events interact in a cascade that produces effects on the fetus or newborn and result in ICH.

Brain injury can occur during different stages of brain development that regulate motor function, and three categories of risk factors are described; prenatal, perinatal and postnatal up to five years of age, as shown in Table 2. Perinatal factors are the most influential group, with preterm birth being the main factor. This is due to the immaturity of the fetal blood vessels and the vulnerability of the oligodendrocyte progenitors, which are susceptible to injury by free radicals, glutamate and proinflammatory cytokines. (Peinado-Gorlat et al., 2020).

Table 2. *Risk factors for infantile cerebral palsy according to the period of action.*

Risk Factors		
Prenatals	**Perinatal**	**Postnatal**
-Infections intrauterine	-Pretterm -Asphyxia perinatal	**-Trauma** **-Infections of the system**
-Pregnancy multiple	-Encephalopathy	**central nervous system**
-Delay of the	neonatal	**-Ictus**

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growth	-Infections	**ischemic**
intrauterine	neonatal	**-Insults**
-Hemorrhages	-Kernicterus	**hypoxic**
-Preeclampsia	-Syndrome	**-Corticoids**
- Malformations	distrés	**postnatal**
congenital	respiratory	
-Disorders	of the newly	
thyroid	born	
maternal		
-Fetal stroke		
(intrauterine)		

Source: (Peláez-Cantero et al., 2021).

The following is a description of the risk factors by stage:

- Prenatal factors (Factors occurring during pregnancy)
- Maternal factors

Diagnostic maternal thyroid function abnormalities during pregnancy

- -Exposure to teratogenic agents (methylmercury or alcohol)
- -Trauma
- Exposure to X-rays
- -Predisposition to abortion
- -Intrauterine infection or infections with viruses
- -Preeclampsia
- -Autoimmune diseases
- -Blood Rh incompatibility
- Placental disorders
- -Chronic vascular changes
- -Hypoxia
- Fetal factors
- -Intracranial hemorrhage damaging brain tissues causing numerous neurological problems.
- -Central nervous system malformations
- -Intrauterine growth retardation
- -Multiple gestation
- -Chromosomal disorders. (Arias Gomar, 2020)

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Perinatal factors (factors occurring during or immediately after delivery)

- -Placental abruption
- -Cardiac surgery
- -Trauma due to falls, blows to the head, among others.
- -Perinatal asphyxia, in the most severe cases of asphyxia, hypoxia-ischemic encephalopathy may occur.
- -Intracranial hemorrhage
- -Maintained hypoglycemia or hyperbilirubinemia
- -Low weight
- -Prematurity (30-40 of ICH cases)

Postnatal factors (Factors occurring after birth, up to three years of age)

- -Metabolic disorders
- -Severe dehydration
- -Intoxication due to the inappropriate use of medications.
- -Cardio-respiratory arrest
- -Convulsive status
- -Cranial trauma
- -Infections (encephalitis, meningitis)

There are other factors for the presence of ICH which with considered, such as whether the risk is higher at lower gestational age, along with gestational age, low birth weight, infections during pregnancy, multiple gestation, bleeding at any time during pregnancy, maternal illness, low Apgar score of 5min (Barrón-Garza et al., 2018). Thus, the study conducted on the risk associated with cerebral palsy mentions that in countries such as the USA, pre- and perinatal risks have been determined, among which it has been found that prematurity has the greatest impact on the development of CP and that asphyxia, defects and adverse events at birth contribute significantly to the future development of CP (Barrón-Garza et al., 2018). (Barrón-Garza et al., 2018).

On the other hand, up to 7% of cerebral palsy cases are attributed to congenital cytomegalovirus (CMV) infection with this viral infection being more common associated with CP (Escobar-Domingo & Becerra, 2019).

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In turn, several studies consider male sex as a risk factor for ICH, since it estimates a ratio between male-female prevalence rates around 1.4:1. (Rodríguez Mariblanca & Cano de la Cuerda, 2021).

In addition, a family history of ICH in parents, siblings or third-degree relatives significantly increases the risk of having another child with the disease. This points to a multifactorial etiology with interaction between genetic components and environmental factors, the most important points being nucleotide mutations, chromosomal or congenital abnormalities, copy number variations and epigenetic modifications that may be involved in neurodevelopment, inflammation and thrombosis.

The socioeconomic stratum also influences the prevalence of ICH in an inverse manner, since in low-income areas with difficult access to health services or when these are deficient, there is a greater risk of maternal infections, malnutrition, preterm delivery, low birth weight, among others.

The diagnosis in ICH is mainly made from the clinical point of view, however, no definitive test has been found to establish the standard diagnosis, especially due to the changes that occur in the central nervous system during maturation. However, early diagnosis is important, therefore the clinical evaluation of this pathology is based on the identification of motor impairment, either of the coordination of movements or muscle tone, thanks to biometric research, there are better and more accurate diagnostic techniques. (Enireb-García & Patiño-Zambrano, 2017).

The definitive diagnosis of ICH should be made after one year of age in term newborns and at 15 to 18 months if preterm; however, other authors mention that the diagnosis should be made at 24 months of age, primarily based on neurodevelopmental assessment and neurological examination (Ruiz-Pingo, 2019).

The physician should examine the patient's motor skills and reflexes. In order to make the correct diagnosis, a physical examination is necessary, since it provides more information. As well as considering The clinical history and anamnesis are important to determine the possible risk factors present that contribute to brain injury, it is also important to carry a strict psychomotor development inquiring about the milestones reached since it is a non-progressive disease. (Adames, 2015; Hercberg, 2016).

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The first clinical signs appear at any time between birth and three years of age. The most important symptoms are alterations of muscle tone and movement, but some early signs that may be associated with suspected alterations are:

Movement disorder, little is known about its prevalence, although more than one type of abnormal movements coexist. They are more frequent in dyskinetic ICP and often appear in combination with spasticity.

Alterations in swallowing and oromotor skills of the newborn Complete absence of cephalic support at 3 months of age.

- No sitting at 8 months of age
- Absence of social smile at 3 months
- Spasms or significant stiffness
- Significant hypotonia

Seizures, their incidence is 36% and manifests as a sign of neurological injury, with frequent onset during the first year of life.

Visual problems (visual deficit due to optic atrophy, blindness of central origin, homonymous hemianopsia, binocular vision loss, strabismus) and auditory problems (in 10-15% of severe CP, but have greatly decreased with the prevention of feto-maternal incompatibility) Hercberg, (2016).

Epilepsy, 35-62% of children develop epilepsy, with the highest incidence in the first year of life.

Speech and language difficulties, impairing and limiting the performance of daily activities and social interactions, which leads these children to social isolation and to be dependent (Villamizar-Carvajal & Pérez-Reyes, 2020).

Language disorders: Dysarthria is more frequent 40%, however, 25% of children with PCI will be unable to produce intelligible language.

Intellectual disability, present in 40-70% of children with ICH, greater in spastic and quadriplegia. (Peláez-Cantero et al., 2021).

During the third or fourth trimester of life more specific symptoms may emerge that allow the classification of the disease, i.e. spasticity, ataxia, or dyskinesia that are related to specific areas of brain damage.

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There are other comorbidities such as gastroesophageal reflux, swallowing disorders expressed in dysphagia, constipation, gastritis, esophagitis, respiratory infections, visual disorders, osteoarticular problems due to muscle imbalance generated by spasticity, malnutrition, among others. (Arias Armijos & Huiracocha Tutivén, 2020)

The prediction improves when neuroimaging techniques are used between 70-90% where visible alterations such as congenital malformations, white matter lesions, focal infarcts, cortical, subcortical or basal nuclei lesions are present. In the neonatal period and in infants, neuroimaging can be accessed through transfontanelar ultrasound where interventricular hemorrhages or periventricular leukomalacia can be observed, but other signs such as isolated ventriculomegaly or cerebellar hemorrhages can also be found. However, most cases do not present indisputable symptoms from the beginning and in current practice the majority of children with CP are diagnosed around the age of 1 or 2 years. (Ccasa Umeres, 2022).. Magnetic resonance imaging, computed tomography, electroencephalogram electroencephalogram and electromyogram are very supportive examinations in the search for brain lesions in children (Lopez-Santacruz et al., 2022). (López-Santacruz et al., 2019).

In case of bilateral spasticity, the lesion is usually located in the periventricular area affecting the pyramidal tract, resulting in a silent evolution during the first 6-12 weeks. After this period, the child adopts a semi-flexed position with spontaneous movements, persistence of primitive reflexes and pyramidal signs, sometimes presenting tetraplegia due to severe global hypoxia or congenital malformations with bilateral involvement. On the other hand, if unilateral spasticity is present, it is more likely to be due to ischemia of a vascular territory, generally in the territory of the left middle cerebral artery. Finally, children with ataxic variant of CPI have cerebellar lesion, presenting less comorbidities and debuting with hypotonia and delayed gross motor development.

Thus, in the study conducted at the Vicente Corral Moscoso Hospital, in 72 patients, 51.4% of whom were male. They showed prenatal characteristics of spastic CP type predominating with 84.7%, having by imaging findings cerebral atrophy in 53.85%, epilepsy was the most frequent comorbidity in 80.6%. The main cause of hospital

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admission was respiratory infections in 43.05%. (Arias Armijos & Huiracocha Tutivén, 2020).

Infantile cerebral palsy (CP) is a heterogeneous condition with multiple clinical manifestations that cannot be cured. However, there are numerous management strategies to achieve a productive life for patients. This involves education, therapy and technology, which must be implemented in a multidisciplinary manner, with the pediatrician as the main focus. Factors affecting this therapy are neuroplasticity, the extent of the lesion and the family nucleus, key elements in the treatment team. Recent studies suggest that the family and the individual's determination are the pillars for achieving long-term goals. Caring for a child with PCI carries an emotional burden for parents, who are under stress due to the time involved in their care, as well as concern for their child's independent and socially productive future. (Escobar-Domingo & Becerra, 2019).

Early identification by the specialist is indispensable to manage neurological function, since early intervention can optimize neuroplasticity, reduce the time to diagnosis from 12-24 months to less than 6 months by means of neuroimaging and standardized neurological evaluation.

The intervention of different specialists contributes to the resolution of each particular case, among this group of professionals there should be rehabilitation specialists, orthopedists and neurosurgeons.

Fundamentally, however, treatment is based on physiotherapy, which seeks to obtain relaxation of the spastic musculature, improve muscle control and coordination, as well as strengthening of the antagonist musculature. Postural management is essential to help execute motor patterns, maintaining muscle length and joint range. (Solís García & Real Castelao, 2019).

In 2017, the National Institute for Health and Care Excellence (NICE) published a clinical practice guideline for the diagnosis and management of infantile cerebral palsy (CP). This guideline recommended assessing motor symptomatology and comorbidities in a personalized and guided manner through functional assessment scales, paying attention to possible secondary musculoskeletal alterations (Valdés Sánchez et al., 2018). Although the most commonly used treatment to treat ICP is physical therapy, occupational therapies, the use of orthoses and speech therapy can also be applied. In addition, alternative therapies such as horse

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therapy or hypnotherapy are being experimented with to improve patient outcomes, especially those with spastic motor disorders. A relatively new technique is the Rocher cage, a mechanotherapy device used to perform frictionless and rotation-free suspension exercises. This technique aims to reduce pathological reflexes, normalize tone, strengthen the musculature and improve functionality.Cantero et al., 2021).

Since many patients have spastic and dyskinetic forms, pharmacological treatment may be a good option to decrease muscle spasm and improve their mobility and function. Drugs prescribed for this are dantrolene, baclofen, tizanidine and benzodiazepines (see Table 3). However, it should be noted that the use of these drugs does not always lead to significant improvement, and they can have side effects such as hepatotoxicity, drowsiness and muscle weakness.

Table 3. *Drug treatment*

DRUG TREATMENT

MOVEMENT DISORDER	TREATMENT
-TRIHEXYPHENIDYL - TRIHEXYPHENIDYL	START: 1 MG/DAY IN 2 DOSES, INCREMENTS OF 1 MG PER WEEK UNTIL THE DOSE IS REACHED. EFFECTIVE, OR UNTIL SIDE EFFECTS APPEAR. HIGH DOSES (>10 MG/DAY) CAN BE ADMINISTERED IN 4 DOSES/DAY. MAX. 2 MG/KG/DAY OR 70 MG/DAY.
-CARBIDOPA-LEVODOPA	INITIATION: 1 MG/KG/DAY IN 3-4 DOSES, PROGRESSIVE WEEKLY INCREASE (0.5- 1 MG/KG) UP TO MAX. 10 MG/KG/DAY. DOSES HIGHER THAN 4-5 MG/KG/DAY ARE NOT NORMALLY USED IN P
SPASTICITY	TREATMENT

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BACLOFEN	**0.75-2 MG/KG/DAY, DISTRIBUTED IN 3 - 4 DOSES. ALWAYS ADMINISTER PROGRESSIVELY UNTIL REACHING:** **1-2 YEARS: 10-20 MG/DAY IN 4 INTAKES (MAX. 40 MG/DAY)** **2-6 YEARS: 20-30 MG/DAY (MAX. 60 MG/DAY)** **> 6 YEARS: 30-60 MG/DAY IN 4 DOSES (MAX. 120 MG/DAY)**
CLONAZEPAM	**OLDER THAN 6 MONTHS-10 YEARS OR 30 KG: INITIAL DOSE: 0.01-0.03 MG/KG/DAY, DIVIDED IN 2 OR 3 DOSES. SLOWLY INCREASE 0.25- 0.5 MG/WEEK UP TO 0.1 MG/KG/DAY. MAXIMUM DOSE**
TIZANIDINE	**0.2 MG/KG/DAY** **> 10 YEARS: INITIAL DOSE OF 1-1.5 MG/DAY, DIVIDED IN 2 OR 3 DOSES. IT CAN BE INCREASED BY 0.25-0.5 MG WEEKLY UNTIL THE INDIVIDUAL MAINTENANCE DOSE IS REACHED. MAXIMUM DOSE 20 MG/DAY** **0.1-0.2 MG/KG/DAY, DISTRIBUTED IN 2 OR 3 INTAKES. AS A GENERAL STARTING DOSE IT IS RECOMMENDED:** **18 MONTHS-7 YEARS: 1 MG/DAY IN A NIGHTLY DOSE** **7-12 YEARS: 2 MG/DAY IN ONE OR 2 DOSES** **> 12 YEARS: DOSAGE SIMILAR TO ADULT STARTING AT 4 MG/DAY IN 2 INTAKES (MAXIMUM DOSE 36 MG/DAY)**
TRIHEXYPHENIDYL	**CHANGE EVERY 3 DAYS ALTERNATING EARS:** **NEONATES > 32 WEEKS-2 YEARS: ¼ PATCH EVERY 72 HOURS** **3-9 YEARS: ½ PATCH EVERY 72 HOURS** **> 10 YEARS: 1 PATCH EVERY 72 HOURS** **INITIATION: 0.1 MG/KG/DAY IN 3 DOSES, IF LITTLE EFFECT, PROGRESSIVE WEEKLY INCREASE UNTIL** **0.5 MG/KG/DAY (MAX. DOSE 10 MG/DAY)**
PROBLEMS OF DREAM	**TREATMENT**

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MELATONIN	**3-15 MG/DAY**
LORAZEPAM	**0.05-0.1 MG/KG/DOSE (MAXIMUM 2-4 MG/DOSE)**
ZOLPIDEM	**OLDER THAN 2 YEARS OF AGE: 0.25 MG/KG/DAY (MAXIMUM 5-10 MG**

Source: (Peláez-Cantero et al., 2021).

On the other hand, in recent years the procedures for the surgical management of spasticity is performed by the orthopedist who also identifies and prevents musculoskeletal and neurosurgical complications have shown their benefit in patients with PCI, for example selective dorsal rhizotomy has proven that it can improve spasticity, because it decreases the power of the spinal reflex by partially sectioning the sensitive afferents between L1 and S1 (Villasís-Keever & Pineda-Leguízamo, 2017).

The implantation of low voltage neurostimulators in the basal nuclei for the treatment of dyskinesia is being studied. While medical or neuropsychiatric comorbidities such as epilepsy, malnutrition, susceptibility to infections or visual and auditory disturbances should have priority management to improve their integration into society. Ccasa Umeres (2022) mentions that another research strategy describes that stem cell therapy contributes to restore brain functions, being tolerated and showing some improvement of symptomatology, but long-term studies are needed to determine the impact of this treatment in patients with PCI.

As far as prognosis is concerned, currently more than 90% of individuals with ICH survive to adulthood, thanks to multidisciplinary treatment. The severity of motor, sensory, intellectual and ambulatory disabilities is decisive in survival (Lopez-Santacruz et al., 2019)..

Conclusions

It is worth mentioning that many of the authors in the literature review are related as it refers to describe about the PCI disease, it is a chronic disabling syndrome that originates in the central nervous system, something that is not far from the majority of authors mentions, where also Enireb-García & Patiño-Zambrano (2017) to

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this fact mentions that the development is limited to the first three years of age and Villasís-Keever & Pineda-Leguízamo (2017) further mentions that it is a permanent and non-progressive disease. Frequently accompanied by other sensitive, cognitive disorders, as considered by Adames (2015).

Barrón-Garza et al., (2018) mentions that it is 2.11 per 100NV. However, (Solís García & Real Castelao, 2019) , mentions that its prevalence has had a progressive increase due to the reduction of morbimortality of those affected and advances in perinatal care, so that Fernández Sierra, (2017) mentions that prematurity is better treated and therefore survival has improved, but the sequelae or disabilities of this group of newborns have increased.

On the other hand, Adames (2015) mentions that there are prenatal, perinatal and postnatal risk factors. The classification is according to where it locates the brain injury is spastic, atheto99=sic, ataxic and mixed forms. While Manzanas Alonso, (2018)mentions that it can be classified by topographic criteria hemiplegia, paraplegia, tetraplegia or double hemiplegia, diplegia and monoplegia.

For (Solis Garcia & Real Castelao, (2019) In the child population, ICH is one of the most relevant neurodevelopmental pathologies, since it is one of the main causes of motor disability, affecting functional independence and the integration of the person into society, and although there is no cure, there are treatments that can improve the integration of these individuals into society.

The clinical characteristics of each patient vary according to the neurological substrate affected, therefore its treatment is multidisciplinary, i.e. with the participation of several professionals in different specialties, so that (Espinoza Diaz et al., (2019) consider that it is necessary to carry out specific care programs where the best possible care is provided, through the application of tools to the subjects and their families to achieve the main objective of the treatment which is to provide the highest degree of functional independence to the individual. Therefore, (Arias Gomar, 2020) mentions that the alterations can be dysarthria, mental deficiency, epilepsy, language problems, pseudobulbar palsy, visual disorders, urinary problems and behavioral problems.

Most authors mention that the diagnosis is made mainly from the clinical point of view, but there is no evidence of a definitive test due

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to changes that occur in the central nervous system during its maturation. But Hercberg (2016).

mentions that the clinical history, family history, neurological, genetic, hereditary, risk factors, motor milestones from birth to the first pediatrician consultation should be considered, so that Enireb-García & Patiño-Zambrano, (2017) mentions that the diagnosis cannot be made until the child is between 6 to 12 months old. While Ruiz-Pingo(2019) mentions that the definitive diagnosis should be made after one year of age in term children and at 15 to 18 months if born prematurely.

For , lomotor disorders are a disease with a deep history in mankind, yet at present there is no cure or total remedy to eradicate it. Researchers continue to search for new and more effective drugs to treat it. The best way to prevent it is to reduce risk factors. The main treatment for rehabilitation is surgery, medicine and physiotherapy, although this is not a complete solution, the goal is for the person to have independence and a better quality of life. ()Villasís-Keever & Pineda-Leguízamo (2017), alludes to hippotherapy as an alternative. In addition, Peláez et. al, mentions that I know is studying new alternatives for its treatment such as stem cells.

Finally, Espinoza Diaz et al., (2019) mentions that the physical and neurological examination are key in the diagnosis, although it is true that the treatments seek the integration of the individual to society, there is still controversy with the extent of this disability and a great discrimination to these patients, so that Coronados Valladares et al. (2021), (2021) mentions that currently the social struggle continues for the integration of these people so that they can have a dignified life, as well as a working life.

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