DEPARTMENT OF HUMAN ANATOMY, SCHOOL OF MEDICINE, COLLEGE OF HEALTH SCIENCES, ADDISABABA UNIVERSITY

PREVALENCE OF CEREBRAL PALSY, ITS ASSOCIATED FACTORS AND MRI PATHO-ANATOMIC FINDINGS AMONG PATIENTS ATTENDING PEDIATRIC NEUROLOGY CLINIC IN TIKUR ANBESSA SPECIALIZED HOSPITAL

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Prevalence of Cerebral palsy, its Associated Factors and MRI Patho-Anatomic findings among patients attending paediatrics neurology Clinic in Tikur Anbessa Specialized Hospital

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ACRONYMS AND ABBREVIATION

ANC: Ante Natal Care

APH: Ante Partam Heamorrhaige

CDC: Center for Disease Control and Prevention

CP: Cerebral Palsy

CPD: Cepalo Pelvic Disproportion

CSF: Cerebro-Spinal Fluid

CNS: Central Nervous System

DM: Diabetes Mellitus

DMD: Duchenne Muscular Dystrophy

ETB: Ethiopian Birr

GBD: Global burden of Disease

GA: Gestational Age

GMFCS: Gross Motor Function Classification System

GBS: Gullaine Barre Syndrome

PGMI: Predominant Grey Matter Injury

PWMI: Predominant white matter injury

HTN: Hypertension

IVH: Interaventricular Hemorrhage

ICSF: International Classification of Function Disability and Health

LBW: Low Birth Weight

MMC: Meningomyelocele

MRI: Magnetic Resonance Imaging

MRICS: Magnetic Resonance Imaging Classification System

MRN: Medical Record Number

PI: Private Investigator

PROM: Premature Rapture of Membrane

PVL: Periventricular Leukomalacia

PVH: Periventricular Heamhoraige

NAGCPP: North America Growth in Cerebral Palsy Project

NCDs: Non Communicable Diseases

NICU: Neonatal Intensive Care Unit

NRFHRP: Non Reassuring Fetal Heart Rate Pattern

RVI: Retro Viral Infection

SCPE: Surveillance of Cerebral Palsy in Europe

SPSS: Statistical Package for Social science

TASH: Tikur Anbessa Specialized Hospital

TORCH: Toxoplasmosis other agents Rubella Cytomegalovirus and Herpes simplex

UK: United Kingdom

USA: United States of America

UTI: Urinary Tract Infection

WHO: World Health Organization

WMDI: White Matter Damage Injury

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Abstract

Background: Cerebral Palsy (CP) describes disorder of movement and posture that appears during infancy/early childhood causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. Any progressive CNS injury occurring during the first 2(some say 5) years of life is considered to be CP. CP may be caused by prenatal, perinatal and postnatal factors.

Objective: The Aim of this study was to assess the prevalence of cerebral palsy, determine its associated factors and Magnetic Resonance Imaging (MRI) Patho-anatomy among patients attending paediatric neurology clinic of Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia.

Method: Hospital based retrospective cross sectional study was conducted in Tikur Anbessa Specialized Hospital with randomly selected sample of 422 patients attending to paediatric neurology clinic from September 2017-Septmeber 2020. Data was collected using checklist by using Kobo Collect version 1.27.3 and was exported to SPSS windows version 25 for analysis. Bivariable and Multi variable binary logistic regression analysis were also carried out to determine the effect of explanatory variables. Level of significance of 5%, and adjusted odds ratio (AOR) with 95% confidence interval (CI) was used.

Result: A total of 402 patients were used. The prevalence of CP was found to be 35.8% among patients who visited the paediatric neurology outpatient clinic. Twelve variables were associated in Bi-variable analysis, of which five variables, that is; sex, preterm delivery, home delivery Null parity and birth asphyxia were significantly associated with AOR 95% CI. (Sex: 1.89[1.11-3.25], preterm: 7.04[1.55-31.82], home delivery: 7.74[1.66-35.95], null parity: 1.7[1-2.9], asphyxia: 4.47[1.76-11.29] respectively). Among the CP cases spastic CP accounted for 88.9% and 62.5% were quadriplegic.58% of CP the patients were reported to have predominant white matter injury.

Conclusion and recommendation: The prevalence of CP in the present study is lower compared to that reported by other African researches. The most significant risk factors for developing CP were perinatal factors such as asphyxia, home delivery and preterm delivery. Among the clinical types spastic quadriplegic type is the commonest and most of the patients are at level 5of Gross Motor Function Classification System (GMFCS). Predominant White Matter Injury was found to be one of the commonest MRI finding.

Most of the factors associated are preventable perinatal problems which can be reduced by decreasing complications during birth, better health care during pregnancy, delivery and postnatal period.
Key words: cerebral palsy, Tikur Anbessa Specialized Hospital, prevalence, Ethiopi

1. Introduction

1.1 Background

Cerebral palsy (CP) is described as a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. It excludes motor disorders solely of spinal, peripheral nerve, muscular or mechanical origin. The motor disorder is often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour; by epilepsy, and by secondary musculoskeletal problems. The motor impairment manifests usually before 18 months of age. Patients may develop a variety of secondary musculoskeletal problems, such as muscle/tendon contractures, bony torsion, hip displacement, spinal deformity and also behaviour and participatory problems are also seen (1).

Primarily CP causes upper motor neuron syndrome (UMN) in childhood which is characterized by positive features such as spasticity, hyper-reflexes and co-contraction, and negative features including weakness, loss of selective motor control, sensory deficits and poor balance(2). Signs and symptoms vary among people and over time. Often, babies with cerebral palsy do not roll over, sit, crawl or walk as early as other children compared to their age group. Other symptoms include seizure and problems with thinking or reasoning, in which each occur in about one third of people with CP(3).

CP is a common cause of physical disability affecting children in developed and developing countries and most common diagnosis after trauma in most paediatrics neurologic outpatient and physiotherapy units, and it makes heavy demands on health, educational, and social services as well as on families and children themselves(2).

CP is classified in to different forms based on Motor abnormality, Accompanying impairment, Anatomical and neuroimaging finding and causation and timing (1). For instance based on motor abnormality, Spastic CP 80% of CP (the most common), Dyskinetic CP is the second most common type(dystonia, athetosis and chorea), Ataxic CP the least common type of CP, Mix of the types CP is a combination of dyskinetic and spastic cerebral palsy (4).

Each year 130 million infants are born worldwide, 93% of whom are born at term, among those 120,000 to 217,600 new cases of CP occur each year in term-born children, Term-born children account for 50 to 65% of children with CP, and they tend to be more severely impaired than children with CP born preterm (5).The risk factors for CP are antenatal, neonatal, post neonatal, or combined (6).

The Gross Motor Function Classification System (GMFCS) was the first Classification system developed for children with CP. GMFCS has different descriptions for 5 different ages and is a 5 level classification (1-5) (7).Similarly a bimanual grading system is devised for fine motor function (BFMF). Fine motor function was classified into four groups for each hand (8).

Cranial MRI is a standard diagnostic procedure safe to use in children. All children with CP should have an MRI scan to provide information on the timing and extent of the lesion(9).In CP patients MRI proves to be abnormal in around 85% of cases. The Surveillance of Cerebral Palsy in Europe proposes the MRI classification system(MRICS) as a reliable tool (10).The MRI classification system divides the imaging into five groups in CP patients: Mal-developments, Predominant white matter injury, Predominant grey matter injury, Miscellaneous and Normal (11).

Brain imaging can provide evidence about the timing of adverse events. For example, cortical dysplasia's date from early in pregnancy, around the 12th to 20th week of gestation, periventricular leukomalacia occurs between the 28th and 34th week, and term infants with perinatal asphyxia have cortical and subcortical gliosis (12)

1.2 Statement of the problem

Prevalence of CP varied widely from country to country. CDC estimates that an average of 1 in 323 children in the U.S. have CP (13)

Children with CP are more likely to experience a range of health and functional problems compared to children without CP, including orthopaedic-related issues, excess body fat deposition, and mental health disorders(14). Consequently, adults with CP are at risk of early development of several medical conditions and increased risk of death because of NCDs (15).

According to Norway national registry the majority (95%) of individuals with CP had at least one additional disorder (16). Based on British birth registry the mortality with CP was 0.65% before 1 year, 1.3% before 2 years, 2.6% before 4 years, and 5% before 10 years of age (17).Level 5 CP patients' needs alternative feeding and are vulnerable to severe respiratory illness and early mortality (18). Compared to the developed the Prevalence is higher in Africa because of the level of perinatal complications such as birth asphyxia and neonatal infections (12)**.**

Children with CP who have very low birth weights have more major medical conditions and are at increased risk of death. Children with moderate or severe CP have poor growth compared with normal children (19).Growth and nutrition disorders are common secondary health conditions in children with CP(20). Many of the children with CP also had at least one co-occurring condition 41% had co-occurring epilepsy and 6.9% had co-occurring Autistic Spectrum Disorder (ASD) (21).

The financial toll of CP on families and communities is overwhelming. CP-related medical costs were found to be 10 times higher than for children without CP (13). Survival rates to 20 years of age in severely disabled (22). CDC has estimated that the lifetime cost to care for an individual with CP is nearly $1 million (2003 dollars) (21).

Despite being the common cause of physical disability in children worldwide, little is reported on this condition in the African context and limited information about CP in sub-Saharan Africa (23)and there is paucity of research and data on CP in Ethiopia. So this study will assess the prevalence and associated factor of cerebral palsy in TASH, Addis Ababa, Ethiopia.

1.3 Significance of the study.

CP puts great demand on health, education as well on families and the children, its prevalence is increasing because of improved survival of low birth weight babies. Understanding the characteristics of children with CP can provide important clues for further research (13).

Little is known about the prevalence, causes, and mortality of cerebral palsy in low-income settings. Being common reason for many paediatric neurological conditions, very little has been reported on this disorder in the African context

The present study is intended to assess the prevalence of cerebral palsy, its associated factor and MRI Patho-anatomic finding among patients attending paediatric neurology clinic of TASH. There is very limited research found in Ethiopia on cerebral palsy, so the research findings will be used as baseline data for further studies on cerebral palsy and related topics.

2. Literature review

2.1 Prevalence

2.1.1 Globally

Cerebral palsy is the most common cause of physical disability affecting children globally. The true prevalence of CP may be underreported because severely impaired infants may die before being diagnosed as CP patients and children who have mild CP do not visit hospital for evaluation (24).

Overall prevalence of CP has remained stable over the years, at between 1 and 3 per 1000 live births (6).Some of the reported rates are 2.5 per 1000 in Finland, 1.9 in England, 2.4 in Sweden, 2.1 in Norway, 2.4 in Malta, and 1.6 in China. The highest reported prevalence rate in a developed country is 4.9 per 1000 in Denmark (25). And also high prevalence is registered in Turk 4.4 per 1000 live births (25).According to CDC in 2008 in USA number of 8-year-old children identified with CP was 451 with total average prevalence of 3.1 per 1,000 (or 1 in 323)(13).

Most of the research shows male predominance in CP prevalence. According to a report from 14 centers in eight European countries there has been a slight dominance of male. Of the children in the study, 61.9% were male, overall the M:F ratio was 1.33:1 in all centers(2). According to Swedish medical registry male to female ratio was found to be 1.36:1 and 57.8% of males and 51.4% of females in Norwegian research (16). Also CDC reported prevalence in boys is 3.6 per 1000 and girls 2.5 per 1000 births, Egyptian study showed similar pattern of male preponderance than female(26). But study in North Iran showed no significant difference as to sex (27).

The prevalence of CP in low-income and middle-income countries is believed to be four to six times higher; however, few data are available. In Vietnam CP comprises 30%–40% of all childhood disability (28)

2.1.2 Africa

Data for developing countries are difficult to obtain and less reliable but suggest a higher prevalence(25). Prevalence of 2-10/1,000 live births in the developing areas (29).Prevalence of 2 recorded in Egypt and 10 in community based cross sectional study in South Africa (30).

In Uganda the prevalence was 2·9 (2·4–3·6) per 1000 children the prevalence was lower in older (8–17 years) than in younger (<8 years) children(31).In a retrospective hospital-based study conducted in a paediatric referral hospital in Khartoum, Sudan 108 children with CP were included and no significant difference in sex was found (32). Nigerian hospitals also reported a prevalence of 16% in Enugu, 16.2% in Ibadan and recent study in Nigeria reported increased prevalence of CP around 42.4% in Kano and 50.3% in Sagamu states. In Tanzanian and Malawian studies the prevalence of CP recorded is 17 per 1000 live births(33).

More recent hospital based studies have reported higher prevalence rates, the high number of cerebral palsy cases visiting the physiotherapy clinic of hospital can be attributed to the accessibility of the hospital and increase in the survival rate due to increased facility at NICU. As in other research, most of the studies done in Africa goes in accordance with male predominance over females in CP patients(34).

2.2 Risk factors increasing prevalence

According to department of paediatrics in university of Washington stated some risk factors which increase the prevalence of CP are deprived socioeconomic populations, Male sex, Racial disparity, Preterm premature rupture of membrane, Perinatal asphyxia, Low Apgar scores, Multiple gestation, Intrauterine infection, Chorioamnionitis and mechanical ventilation >7d (24).

Origin of CP was classified as prenatal in 26.6%, perinatal/neonatal in 18.5%, postnatal in 5.9%, and unclassifiable in 48.9%(25). The overall increase in cerebral palsy reflects the increased survival rates of these infants (35).

2.2.1Associated factor

According to literature, factors are classified into antenatal (prepartum), peripartum (intrapartum) and postpartum. Intranatal causes were the commonest risk factors associated with cerebral palsy (seen in 72% of cases) followed by postnatal causes (seen in 40% cases). 38% cases had more than one risk factor from Indian report(36).

CP between 2000 and 2004 in Poland showed low birth weight (45.1%), preterm birth (40.5%), and birth asphyxia (34.6%) was strongly associated, also maternal infection followed by neonatal sepsis were strongly associated with CP in preterm babies(37). In the USA prematurity contributes half or less of CP(38).

2.2.2.1Antenatal

Birth defect, Small for gestational age status and low birth weight consistently increased risk(39). According to SA study the most common antenatal risk causes identified in the study were cerebral malformations (54.2%) and cerebrovascular events (20%)(39).From Beijing study risk for CP in LBW infants was 5.83 times higher than that in infants with birth weight of 2500 to 4000 g(40).

Maternal diseases like respiratory and heart diseases, seizures, and incompetent cervix, bleeding in the second and third trimesters and pre-eclampsia. According to University of California full-term infants exposed to chorioamnionitis also exhibit an increased risk of cerebral palsy(41).Similar findings on Cameroon research on antenatal factors but additionally: the site of antenatal consultation and malaria were also found to be factors affecting the prevalence of CP(42).

In a cohort study done in California from 1991-2003 Independent risk factors for CP included advanced maternal age, black ethnicity, and IUGR(43-45)

2.2.2.2Intrapartum

Birth asphyxia, despite the variations in reporting, was the strongest and most consistent risk factor. Meconium aspiration were also strong risk factors for births at all gestational ages. Instrumental deliveries, breech delivery, abnormal duration of labour and foetal presentation were reported as statistically significant risk factors in studies of all CP, From the British study in 2004 Peripartum factors: Placental abruption was associated with an increased risk of CP(38, 46-48).

2.2.2.3 Neonatal

Overall, the magnitude of association was greatest for factors in the neonatal period. Among the neonatal variables, the presence of seizures was the strongest risk factor across all gestational ages. Respiratory distress syndrome, hypoglycaemia, and infections were similar in their magnitude of risk(45). Oligohydramnios and polyhydramnios to be major associated risk factors in African research(42). Neonatal sepsis was a strong risk factor for CP in all gestational age groups in UK research research(39, 46).

Although cerebral palsy rates are thought to be similar in developed and developing countries, the aetiology does seem to differ because in developing countries birth asphyxia, kernicterus and central nervous system infections (tuberculosis, bacterial meningitis, cerebral malaria) are major contributing factors (39, 49).

Leading risk factors associated with cerebral palsy were birth asphyxia, convulsions of unknown aetiology, low birth weight and meningitis according to Tanzanian report(50).Similar pattern shown in Nigeria, birth asphyxia 42.5% which is the leading associated risk factor (causing hypoxic ischemic encephalopathy), severe neonatal jaundice (NNJ), (causing bilirubin encephalopathy), and prematurity appear to be the most important factors associated with CP(51).

2.3GMFCS LEVEL

GMFCS has 5 levels. Hemiplegic type mostly categorized from level I through level III on GMFCS scale, while quadriplegic are more labelled on level III through level V (26).In different studies the report is different on GMFCS level, for instance from a retrospective study done in UK Only 12% sit independently and 5% could walk unaided (52).From Canadian research in 2010 the distribution of GMFCS levels were: I-44.6%, II-9.5%, III-12.4%, IV-17.4%, V-16.1% (53).

In most of the findings mild type is the commonest. More than half of CP patients seen in Nigeria (Enugu) were ambulatory with mild to moderate motor dysfunction based on the GMFCS. Those in levels I – III were ambulatory while those in levels IV & V (46%) were non-ambulatory (34).

2.4 Motor types of CP

Cases with CP has been divided according to motor type into spastic (72.5%), dyskinetic (16%), ataxic (7%), and hypotonic (4.5%). Spastic cases have been further categorized according to the distribution of spasticity to diplegic, quadriplegic, and hemiplegic (29).

Spastic CP accounts most of the CP cases for 50 to 60% of all cases in the joint finding from European study and 77.4% from the American report of CDC, while Dyskinetic CP accounts for less than 10% of all forms of CP (18).The topical distribution in London research showed very high rate of diplegia and the relatively low rates of other types of cerebral palsy (54). In the Sudanese and Iranian study the most common type of CP in children is spastic quadriplegic (55). Commonest motor type is spastic CP but the topical distribution differs in different research.

2.5 MRI findings for CP patients

Abnormal neuroanatomical findings are found in 80% to 90% of children who have CP and are detected more often with MRI with white matter damage being the most common abnormality seen.(24, 53, 56-58).

From the European cerebral palsy study of MRI scan showed WMDI, including PVL was the most common finding (42.5%), followed by basal ganglia lesions (12.8%), cortical/subcortical lesions (9.4%), malformations (9.1%), focal infarcts (7.4%), and miscellaneous lesions (7.1%). Normal MRI findings were present in 11.7%.(9)Similarly findings from the UK showed PVL in 70% of CP in babies of preterm and 30% of CP in term born babies. Late third trimester insults tend to affect both grey and white matter structures.(18). From the journal of child neurology systemic review, Pure grey matter damage was the rarest image finding, reported in only 6% of patients (59).

2.6 Conceptual frame work

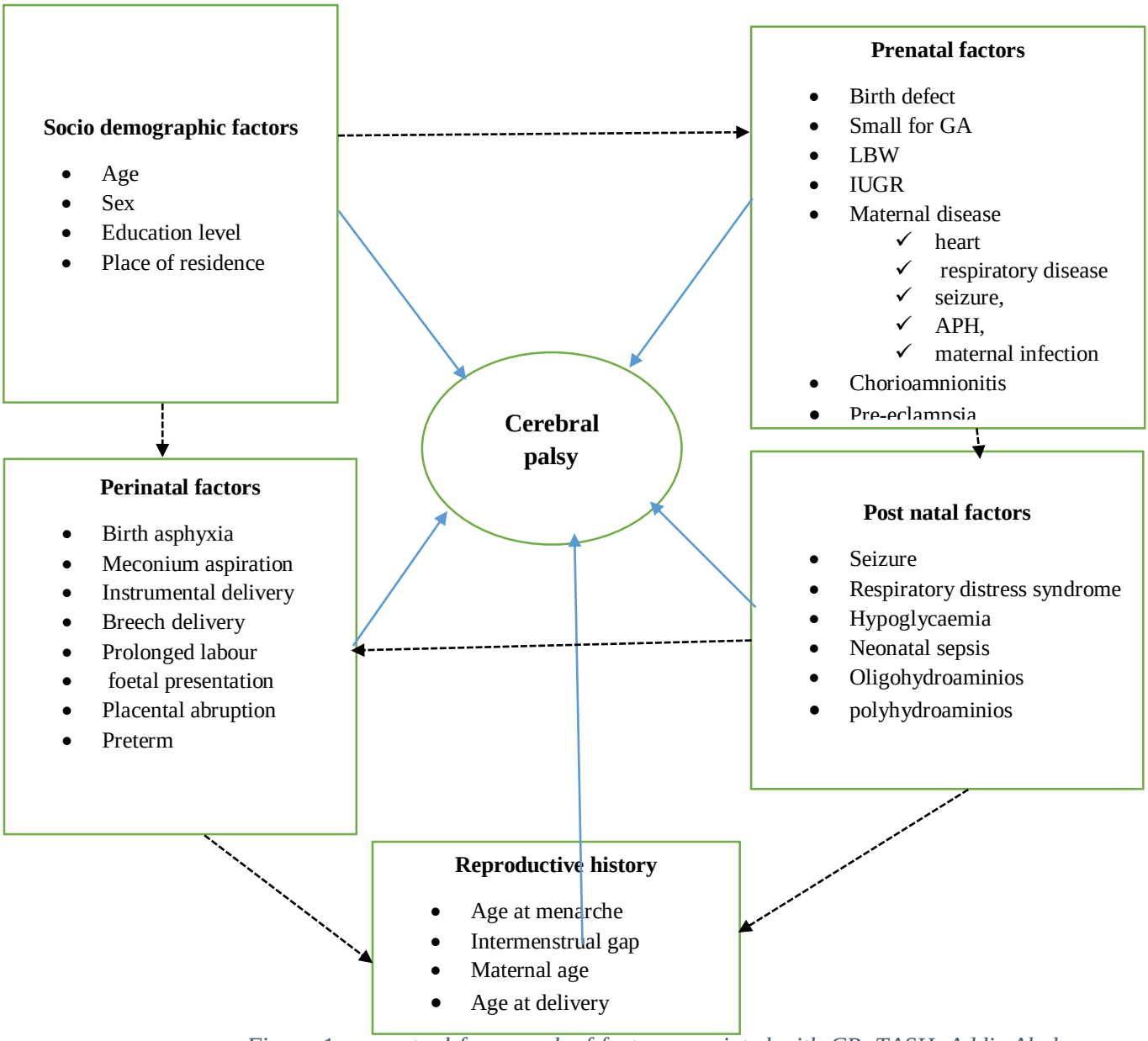


Figure 1 conceptual framework of factor associated with CP, TASH, Addis Ababa, Ethiopia, 2021

---> The broken line indicates the association between the groups of explanatory variables

→ The solid line indicates the association between the outcome variable and explanatory variables

3. Objective

3.1 General objective

- ✓ To assess the prevalence of Cerebral Palsy, its associated factor and MRI patho-anatomy findings among patients attending paediatric neurology outpatient clinic in Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia.

2.2 Specific objective

- ✓ To describe the prevalence of cerebral palsy among patients attending paediatric neurology outpatient clinic and physiotherapy unit
- ✓ To determine associated factors of cerebral palsy among CP patients
- ✓ To assess the type and level of motor abnormality among CP patients
- ✓ To compare anatomical findings on MRI among CP patients

4. Method and Material

4.1 Study area and Period

The study will be conducted in Tikur Anbessa specialized Hospital, school of medicine college of health science, Addis Ababa University from February 15 to April 15/ 2021. TASH is the largest referral hospital in the country. It's the main teaching hospital for both clinical and preclinical training of most study. The hospital has 800 beds, with 130 specialists, 50 non-teaching doctors.

The department of orthopaedic surgery is one of the main departments in Black Lion Hospital. It was founded and established in 1987 as the premium orthopaedic center in the country. In general the department has 75 beds for admitting patients, of which 20 is for paediatric age groups. One of the departments concerned with CP diagnoses is paediatric outpatient clinic which includes paediatric neurology clinic and paediatric seizure clinic which are attended by neurologist, residents, general practitioners and nurses. The paediatric neurology clinic gives service for patients every Tuesday afternoons and provides follow-up care to an average of 30 patients per clinic session(60).

4.2 Study design

- ✓ Hospital based retrospective cross sectional study.

4.3 Population

4.3.1 Source population

- ✓ All patients who visited pediatric neurology outpatient clinic and pediatric physiotherapy unit of TASH.

4.3.2 Study population

- ✓ Patients who visited paediatric neurology outpatient clinic and paediatric physiotherapy unit of TASH from September 2017 to September 2020

4.4 Eligibility criteria

4.4.1 Inclusion criteria

- ✓ All patients attending paediatric neurology clinic of TASH in the study period.

4.4.2 Exclusion criteria

- ✓ Medical record of patients with incomplete data registry greater than 20% of the variables
- ✓ Those records in which MRN is available but the records which are lost from record office during data collection

4.5 Sample size determination and sampling technique

4.5.1 Sample size determination

Since there is no study conducted so far in Ethiopia that assesses prevalence of cerebral palsy the estimated prevalence of cerebral palsy was taken as 50%. And the sample size required for this study was determined by using a single population proportion formula.

$$ni = \frac{(Z\alpha/2)2\ p\ (1-p)}{d2}$$

Where: ni= minimum sample size required for the study

Z= standard normal distribution (Z=1.96), CI of 95% = 0.05

P= prevalence of cerebral palsy; Hence; p=50 % (0.5) was used

d=Absolute precision or tolerable margin of error= 5 % (0.05)

$$ni = \frac{(1.96)2 \times 0.5\ (1-0.5)}{(0.05)2} = 384$$

By adding 10% non-response rate the final sample size will be 422

4.5.2 Sampling technique

Simple random sampling technique was used to select medical charts. Digital record of the hospital was used as a sampling frame. First MRNs was obtained from the HMIS registration book in the year from September 2017 to September 2020. Then a medical record which meets the eligibility criteria of the study was selected by lottery method. 422 sample patients were selected from paediatric neurology unit from September 2017-September 2020.

4.6 Study variables

4.6.1 Dependent variable

- ✓ Cerebral palsy

4.6.2 Independent variables

- ✓ Socio demographic variables (age, sex, education, residence)
- ✓ Reproductive history (maternal age at delivery)
- ✓ Antenatal or prenatal related factors (birth defect, cerebral malformation, Gestational Age(GA), Birth Weight (BW), Intra Uterine Growth Restriction (IUGR), maternal diseases, incompetent cervix, bleeding in the second and third trimester, placental abruption, pre-eclamsia and chorioamnionitis and maternal infection like TORCH)
- ✓ Intrapartum or perinatal related factors (birth asphyxia, meconium aspiration, instrumental delivery, duration of labour and foetal presentation, preterm birth, oligohydroaminios and polyhydroaminios)
- ✓ Postnatal related factors (seizure, respiratory distress syndrome, hypoglycaemia, neonatal sepsis)
- ✓ Types of CP
- ✓ Severity level

4.7 Definitions of terms and operational definitions

Gross motor Function Classification system

- LEVEL 1 - walks without restrictions: limitations in more advanced gross motor skills
- LEVEL 2 - walks without assistive devices: limitations walking outdoor and in the community
- LEVEL 3- walks with assistive mobility devices; limitations walking outdoors and in the community
- LEVEL 4- Self mobility with limitation: children are transported use power mobility outdoor and in the community
- LEVEL 5- Self-mobility is severely limited even with the use of assistive technology
- **Monoplegia**: Means only one limb is affected.
- **Diplegia:** Usually indicates the legs are affected more than the arms; primarily affects the lower body
- **Hemiplegia:** Indicates the arm and leg on one side of the body is affected
- **Triplegia**: Indicates three limbs are affected. This could be both arms and a leg, or both legs and an arm.
- **Quadriplegia:** Means that all four limbs are involved.
- **Spasticity:** hypertonia in which resistance to externally imposed movement increase with increasing speed and varies with direction of movement and /or rises rapidly above a threshold speed
- **Dyskinesia**: involuntary, sustained or intermittent muscle contraction causing a twisting and repetitive movement, abnormal posture or both
- **Ataxia**: abnormal pattern of posture and/or movement with loss of orderly muscle coordination so that movements are performed with abnormal force, rhythm and accuracy.
- **Bad obstetric history:** previous abortion history, early neonatal death, still birth, IUFD, IUGR and congenital anomalies.

Diagnosis of CP takes time and observation (in majority of cases up to 2 years). There is no quick test to confirm or rule out. It is the most prevalent cause of persisting, non-progressing, motor function (movement and posture) and impairment, predominantly spastic.

Diagnosis is clinical and involves six motor abnormality groups: (major motor categories)

- Postures and movement patterns

- Oral motor patterns
- Strabismus
- Tone of muscle
- Evolution of postural reactions and landmarks
- Deep tendon, plantar and infantile reflexes
    - CP considered when ≥ 4 (61)

4.8 Data collection technique

Data was collected by reviewing three years of medical records of patients (September 2017-September2020) who visited paediatric neurology clinic of TASH.

A checklist was used to collect patient variables including socio-demographic factors, and other features by using ODK version 1.9.0. Data on MRI profiles of the patients was obtained from the medical chart of the MRI report.

The checklist was prepared in English. Once the data is collected from the record, was marked to prevent duplication of the information.

The data was collected by three BSc nurses and two days training was given prior to the day of data collection.

4.9 Data quality assurance

To maintain data quality, training was given for data collectors and supervisors. Properly designed data collection materials were developed. In order to check the tool pre-test was done on 5% of the study population (which is 21) in St. Paul Hospital then possible adjustment and modification was made on the tool. Supervision was carried out daily to check completeness, consistency and clarity by both the supervisor and the principal investigator at the end of each data collection day.

4.10 Data processing and analysis

The data was checked after each data collection for completeness. Data which is collected by ODK was exported to SPSS for analysis. Univariate analysis like simple frequencies tables, percentages, mean, standard deviation, bar chart, and pie chart was used. Bi variable analysis using binary logistic regression was done to see the effect of each independent variable. The variables with P< 0.25 in Bi variable analysis were included in multivariable analysis to control confounders. Then variables with P≤0.05 was interpreted as factors significantly associated and AOR with 95% CI was identified to measure the strength of the associations.

4.11 Ethical consideration

Ethical clearance was obtained from the Department Research Ethics Review Committee (DRERC), Institutional Review Board (IRB), Addis Ababa University, and Department Of Anatomy. Official letter or clearance was sent to the department of orthopaedics to get permission for data collection. The obtained result was presented anonymously

4.12 Dissemination of the result

The results of the study will be presented and submitted to Addis Ababa University, College of Health Sciences, School of Medicine, Department of Anatomy and paediatric neurology outpatient clinic and paediatric physiotherapy unit. The findings of the study will be also spread through publication

5. Result

5.1. Prevalence of CP

5.1.1. Socio-demographic characteristics

A total of 402 samples were collected of which 35.8% were CP patients, in which 74.3% of them were confirmed diagnoses with MRI. Of the CP 55.6% were males and 44.4% were females with a ratio of 1.25:1. The median age among CP patients was 5 year (3, 10) years. Most of the CP patients were in 2-4 age group (32.6%). More than half of the CP patients were from Addis Ababa (62.5%) and from those whose age is appropriate for enrolling to school 66.7% had no formal education, 33.3% started primary education. Socio demographic status and distribution of cases among the samples are shown in Table 1 and fig.2 respectively.

5.1.2. Clinical classification of CP patients

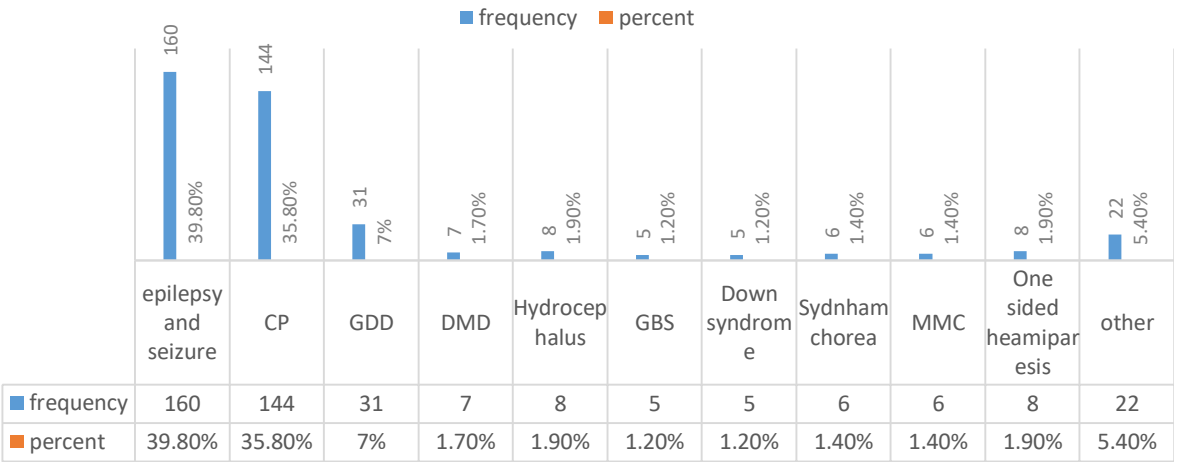
Cases with CP are divided according to their motor type into spastic (88.9%), dyskinetic (7.6%), ataxic (1.4%) and mixed (2.1%). Based on topographic pattern CP is further categorized as diplegic, triplegic, quadriplegic, and hemiplegic. Among the spastic most of the recorded cases were quadriplegic (62.5%) followed by hemiplegic. According to the levelling of GMFCS, most of the patients were in level 5 (29.9%) of which 29% were spastic. Common complications that are observed in CP were GDD (37.2%) followed by epilepsy (28.8%), malnutrition (11.9%) and visual problem (9.1%). Table 2 sub types of CP more expressed.

Among the five motor types of CP, spastic CP accounts the majority and most of the patients among the spastic are on level 5 of GMFCS

Among the 144 CP patients, 107(74.3%) cases are confirmed with MRI. Of those, CP patients with MRI abnormality are 62(58%) and the rest 45(42%) are CP patients with normal MRI result. Patients with PWMI are 58% (of which PVL occurred in 35.5% and IVH occurred in 22.5%), with predominant GMI are 17.7%, with Miscellaneous results are 13% and MRI results with Mal-development are 11.2%.(Figure 4)

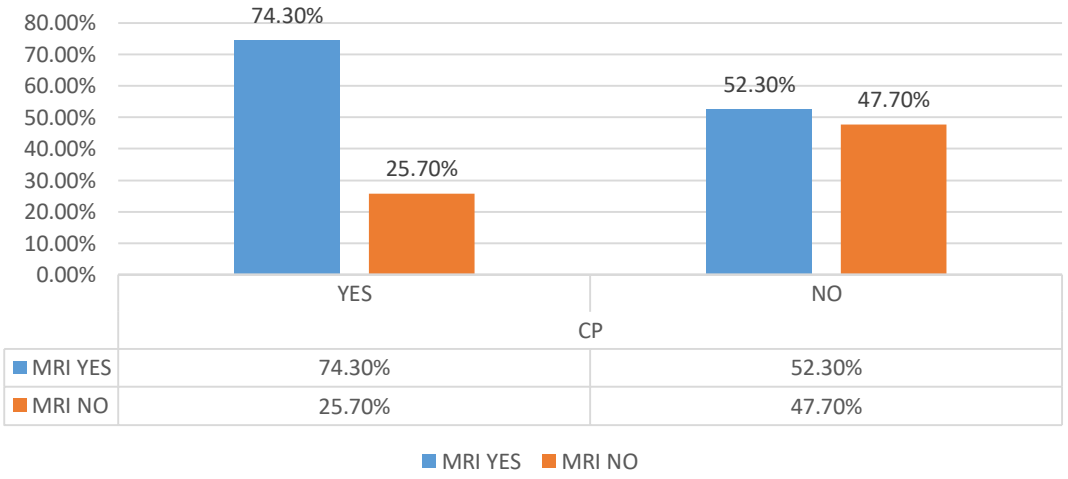
Table 1. Socio-demography of patients attended paediatric neurology and physiotherapy unit of TASH

Variables		Cerebral Palsy (N=144)	Total Sampled patients (N=402
Age	<2	10(6.9%)	35(8.7%)
	2-4	47(32.6%)	105(26.1%)
	4-6	37(25.7%)	74(18.4%)
	6-12	34(23.6%)	116(28.9%)
	12-18	16(11.1%)	72(17%)
Sex	Male	80(55.6%)	248(61.7%)
	Female	64(44.4%)	154(38.3%)
Place of residence	Urban	126(87.5%)	354(88.1%)
	Rural	18(12.5%)	48(11.9%)
Address	Addis Ababa	90(62.5%)	254(63.2%)
	Amhara	14(9.7%)	30(7.5%)
	Oromia	29(20.1%)	88(21.9%)
	SNNPR	8(5.6%)	24(6%)
	Other	3(2.1%)	6(1.5%)
Educational status	No formal education	42(66.7%)	75(34.1%)
	Primary school started	21(33.3%)	140(63.6%)
	Primary school completed		5(2.3%)



	epilepsy and seizure	CP	GDD	DMD	Hydrocephalus	GBS	Down syndrome	Sydnham chorea	MMC	One sided heamiparesis	other
frequency	160	144	31	7	8	5	5	6	6	8	22
percent	39.80%	35.80%	7%	1.70%	1.90%	1.20%	1.20%	1.40%	1.40%	1.90%	5.40%

Figure 2 Distribution of the diseases among the samples (n=402) in paediatric neurology and physiotherapy unit of TASH



	YES	NO
MRI YES	74.30%	52.30%
MRI NO	25.70%	47.70%

Figure 3 percentage of CP patients with MRI scan visited paediatric neurology and physiotherapy of TASH

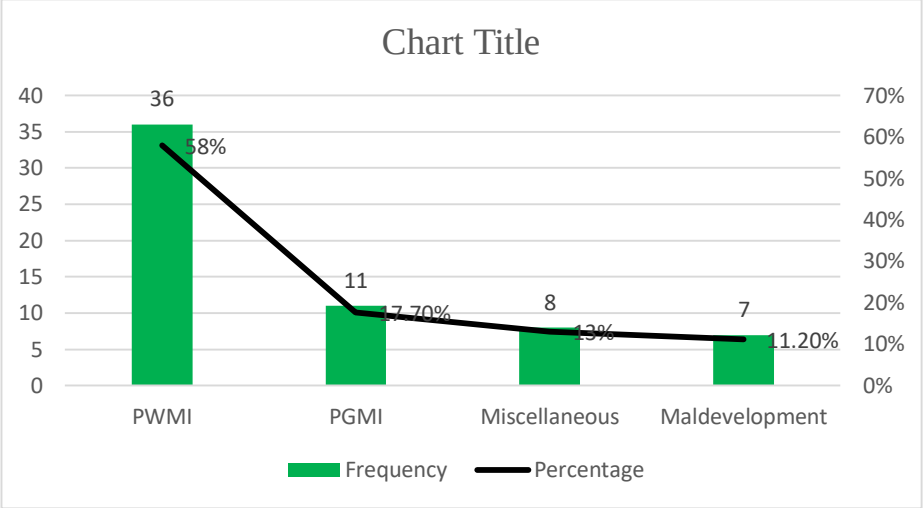


Figure 4 MRI findings of CP patients among paediatric neurology and physiotherapy unit of TASH

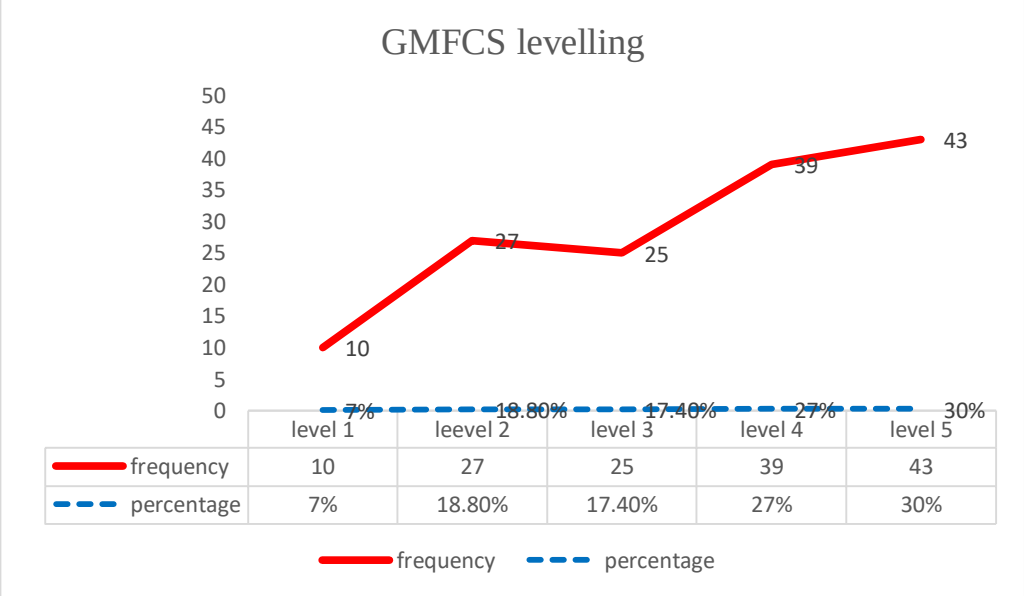


Figure 5 GMFCS OF CP patient among paediatric neurology and physiotherapy unit of TASH

Table 2. Sub-type and topographic pattern of CP among patients in paediatric neurology and physiotherapy unit of TASH

Subtype of CP (n=144)	Frequency	Percent	Total
Spastic	128	88.9%	144
Dyskinetic	11	7.6%	
Ataxic	2	1.4%	
Mixed	3	2.1%	
Topographic pattern			
Hemiplegic	39	27.1%	144
Diplegic	14	9.7%	
Triplegic	1	0.7%	
Quadriplegic	90	62.5%	

CP distribution differs among different age groups in severity level.

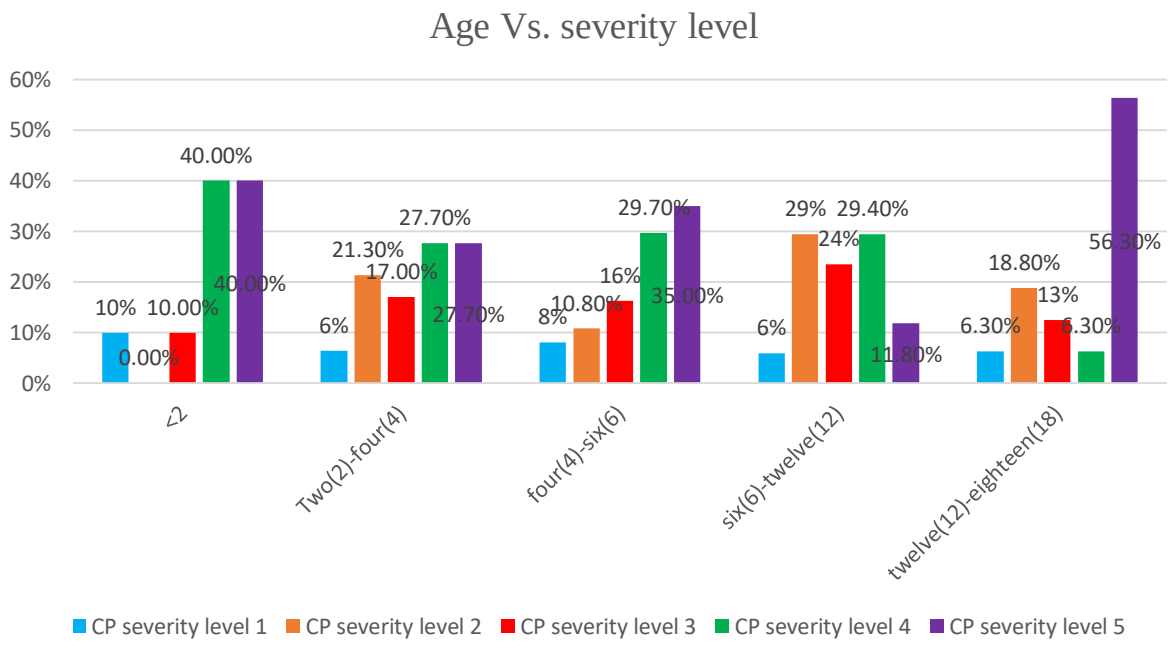


Figure 6 Age versus severity level among CP patients in paediatric neurology and physiotherapy of TASH, AA, Ethiopia

5.1.3. Maternal related factors

Half of the mother's age of CP patients' during delivery is in between 26-36. Among the CP patients 84.7% of mothers had their ANC follow up during pregnancy of which 80.3 %(98) completed up to 4th ANC and 19.7 %(24) dropped attending ANC in the middle. Half of the mothers (51.4%) are multiparous. In 6.8% of the cases CP occurred in previous children were seen in the household and in 6.3% of the cases multiple pregnancy was observed.

In 10.4 %(15) of the CP cases the mothers had infection during pregnancy, of which 11 had UTI, 1 with RVI, 2 TORCH infection and 1 chorioamnionitis. Of the total 34 (23.6%) of mothers developed complication during pregnancy where; 20 (51.2%) of them developed preeclampsia, 7(17.9%) APH and 12 (33.3%) of them are with other obstetrics condition.

8.4% of mothers of CP patients had chronic disease, 1 with heart disease, 6 DM and 2 HTN.

Table 3. Maternal health related factors during pregnancy in paediatric neurology and physiotherapy unit of TASH

Variables		Frequency	Percent
Previous birth(n=144)	Yes	74	51.4%
	No	70	48.6%
Similar condition in previous child (n=74)	Yes	5	6.8%
	No	69	93.2%
Maternal chronic disease (n=144)	Yes	13	8.4%
	No	131	91.6%
Chronic disease (n=12)	Heart ds	1	8.3%
	DM	6	50%
	HTN	2	16.7%
	Other	4	33.3%
Infection during pregnancy (n=144)	Yes	15	10.4%
	No	129	129%
Infection during pregnancy (n=15)	UTI	11	73.3%
	RVI	1	6.7%
	TORCH	2	13.3%
	Chorioamnionitis	1	6.7%

5.1.4. Perinatal and postnatal related

Babies with CP weighting <2500 at birth were 17.4% and 82.6% were in between 2500-4000gm. Of the 144 CP cases 100(69.4%) had complications during birth.

Among the CP cases 9.8% were born preterm, 86% born at term and 4.2% at post term. 45.8% of the neonates had infection during neonatal period showing signs and symptoms for infection, where 53% of them showed poor feeding, 47% breathing difficulty, 15.2% persistent crying and in 69.7% of the cases infection was confirmed as an admission diagnosis

Most of the CP patients about 70.8% had a history of asphyxia during birth and in 96.1% of cases the asphyxia is proved with record

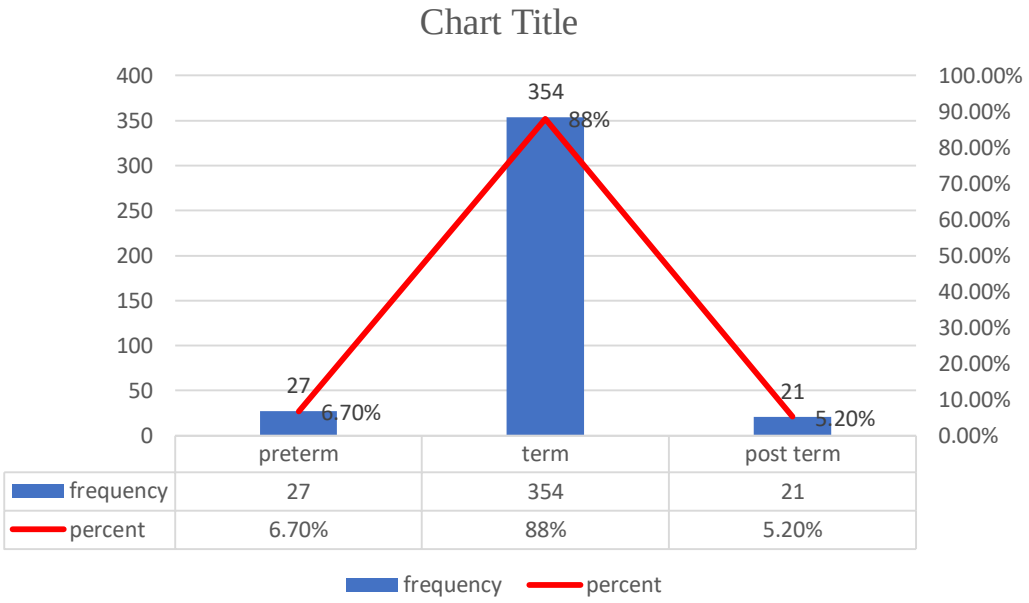


Figure 7 Birth classification of patients among paediatric neurology and physiotherapy unit in TASH

Table 4 : perinatal and postnatal related factors for prevalence of CP in paediatric neurology and physiotherapy unit of TASH

Variable	Frequency	Percent	Total

Type of delivery (n=402)	Instrumental	Yes	26	18.1	402
		No	37	14.3%	
	CS	Yes	39	27.1%	
		No	50	19.4%	
	Breech delivery	Yes	6	4.2%	
		No	5	1.9%	
	Vaginal Delivery without complication	Yes	34	23.6%	
		No	146	56.6%	
	Vaginal Delivery with complication	Yes	28	19.4%	
		No	16	6.2%	
	Home delivery	Yes	11	7.6%	
		No	4	1.6%	
Weight of the baby (n=402)	<2500	Yes	25	17.4%	402
		No	29	11.2%	
	2500-4000	Yes	119	82.6%	
		No	225	87.2%	
	>4000	Yes	0	0%	
		No	4	4%	

Yes/No….are for CP and not for that specific category in the above table. The sum of numbers (yes +no) in the category are the total representation of the category

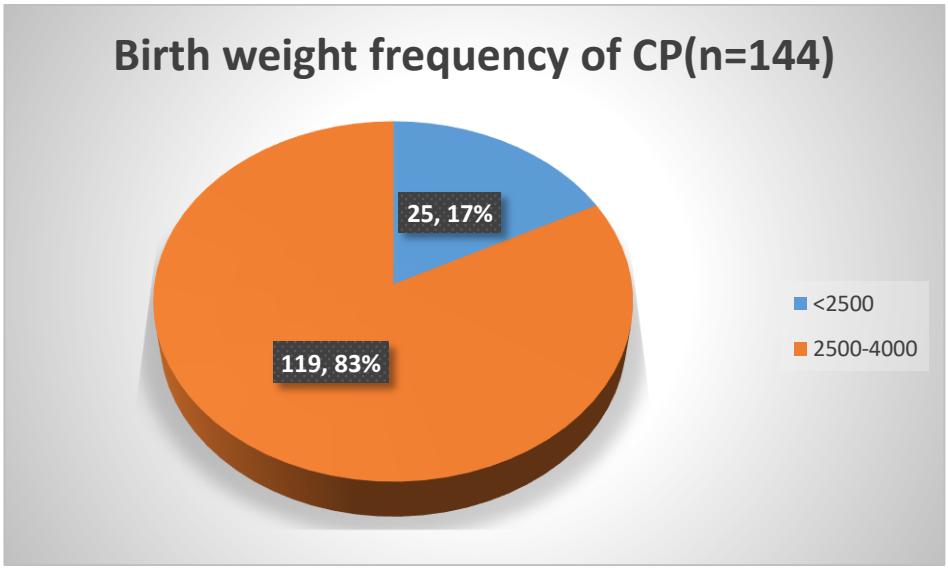


Figure 8 Frequency birth weight of CP children attended paediatric neurology and physiotherapy unit TASH

5.2. Factors affecting CP prevalence

In bivariable analysis($p<0.25$) 11 variables are associated, which are age of the child, sex of the child, maternal ANC visit, previous birth, maternal chronic disease, increased BP during pregnancy, complications during birth, home delivery, preterm birth, sign of infection during neonatal period, asphyxia during birth. Of those variables 5 variables are significantly associated in multivariable analysis ($p<0.05$).

Factors which are significantly associated with CP are sex of the child, preterm birth, home delivery, asphyxia, null parity.

Being male is a protective factor, among the CP patients, the odds of being female is 2 times higher than males [AOR = 2; 95% CI: 1.17-3.35]. And also among the CP patients the odds of being preterm is 3.4 times higher compared to term babies [AOR = 3.4; 95% CI: 1.33-8.4]. The odd of home delivery among the CP patients is 10 times higher compared with institutional deliveries [AOR = 10; 95% CI: 2.43-43]. The other variable is Asphyxia, among the CP patients the odds of being asphyxiated is 4.7 times higher than deliveries without asphyxia [AOR = 4.7; 95% CI: 1.9-11.9]. The last variable to be significantly associated is history of null parity with 1.7 times higher than those with no previous birth history [AOR=1.7; 95% CI: 1-2.9]

Table 5. Bivariable and multi variable logistic regression analysis result of factors associated with CP prevalence in TASH

Explanatory variables		Frequency	COR 95% CI	AOR 95% CI	P value
Sex	Male	248 (61.3%)	1	1	-
	Female	154 (38.7%)	1.5(0.9-2.2)	2(1.2-3.3)	0.01*
Age	<2	35 (8.7%)	1.4(0.5-3.5)	0.47(0.2-1.4)	0.19
	2-4	105 (26.1%)	2.8(1.4-5.5)	2(0.9-4.6)	0.1
	4-6	74 (18.4%)	3.5(1.5-7.1)	2.5(1-6.2)	0.03*
	6-12	116 (26.9%)	1.4(0.7-2.8)	1.3(0.6-3.1)	0.45
	12-18	72 (17.9%)	1	1	-
Type of delivery	Home delivery	15 (3.7%)	5.2(1.6-16.8)	10(2.4-43.3)	0.002*
	Institutional delivery	387 (96.3%)	1	1	-
Previous birth history	Yes	162(40.2%)	1	1	-
	No	240(59.7%)	1.7(1.1-2.5)	1.7(1-2.9)	0.04*
ANC visit	Yes	352 (87.5%)	0.65(0.3-1.2)	0.98(0.4-2.2)	0.96
	No	50 (12.4%)	1	1	-
Maternal chronic disease	Yes	333(82.8%)	1	1	-
	No	69(17%)	3(1.56-5.8)	1.85(0.8-4)	0.1
Birth classification	Preterm	27(6.7%)	2(0.9-4.4)	3.4(1.3-8.4)	0.01*
	Term	354(88%)	1	1	-
	Post term	21(5.2%)	0.7(0.3-1.9)	0.5(0.2-1.8)	0.3
Birth asphyxia	Yes	159(39.7%)	8.5(5.3-13.5)	4.7(1.9-11.9)	0.001*
	No	243(60.4%)	1	1	-
Neonatal infection	Yes	122(30.3%)	3(1.9-4.7)	1(0.6-1.9)	0.82
	No	280(69.6%)	1	1	-
Complication during birth	Yes	167(41.5%)	6.4(4.1-10.1)	2.1(0.9-5.4)	0.09
	No	235(58.4%)	1	1	-
Pregnancy induced hypertension	Yes	39(9.7%)	0.58(0.3-1.2)	0.7(0.3-1.9)	0.6
	No	363(90.2%)	1	1	-

*significantly associated variables in multivariable analysis

6. Discussion

In this study, data of 402 patients were analysed, among which 144 were found to be CP patients, making the prevalence of CP 35.8%. CP prevalence is mostly underreported because some patients die before birth (62). Even though there is a great decrease in perinatal mortality worldwide there seems to be no significant change in the prevalence of CP, rather increased prevalence were observed in the developed countries due to improved NICU(63). Two institutional based cross sectional studies done in Nigeria reported the prevalence of 42.4%(Kano) and 50.3%(Sagamo) (64). Compared to the Nigerian study, lower prevalence in our setting was recorded and these differences might be attributed to difference in sample size, study design, difference in population number and since this study is done in the capital city (Addis Ababa, TASH) some of the cases which might be found in the remote area might not be reported. (63).

According to findings of current the study sex of the child, age of the child, preterm baby, home delivery, asphyxia and null parity were independently factors which are associated with CP

Most of the researches reported risk of CP were higher in male sex (65-67) .In a Turkish study CP was 2x more prevalent in males but in Iranian and American study sex was not significant (68, 69). The protective effect of female gender is unknown (70). Unlike the findings in other researches being male was found to be a protective factor in this study. Among the CPs the odd of being female was 2 times higher than males. Generally the correlation between sex and CP is not known clearly.

In this study age ranged in the study from 1 month up to 17 years (with median age of 5 years). Most of the patients were in the age group 4-6. In a Ugandan research the prevalence of CP was lower in older (8-17 years) than in younger (<8 years) children (71). Since the aetiology of CP is unclear and often because CP is a symptom complex, clinically defined at 4-5 years of age (21) it is mostly expected for the patients to come to health care at the age where they are expected to sit, walk and do some activity.

The majority of CP cases (85%–90%) were congenital (before or during birth occurring CP). In many cases, the specific cause is not known (21). In developing countries 4-9 million birth asphyxia and 1 million neonatal deaths due to asphyxia are recorded annually which comprises 20-40% of all neonatal deaths (63). Generally Perinatal asphyxia was implicated as cause of CP in 20-40% of cases in low income setting compared with 7-10% in Australia (72). Sudanese research also presented birth asphyxia as the main etiological cause of CP which accounted for

26.9% (32). In this study, similar pattern of associated factor was observed, asphyxia was also significantly associated with CP. Among the CP cases, 22.2% were asphyxiated during birth. This level of prevalence was slightly lower than the Sudanese report. The odd of being asphyxiated during birth was found to be 4.47 times greater than non-asphyxiated.

There are different mechanisms which are proposed to how asphyxia causes brain damage. Prolonged asphyxia will cause energy depletion in tissues that depend on aerobic metabolism, such as the CNS, causing the most sensitive areas in the brain to die. In areas that are more resistant, excessive excitability of neurons, abundant ionic calcium influx, free radical generation, and changes in mitochondrial metabolism might cause secondary energy exhaustion and programmed neuronal death. Thus, these irreversible brain injuries during early brain development might ultimately result in CP. Still the correlation between the two is unclear(73).

The wide difference in figures of asphyxia, between the developed and developing countries might be the result of low monitoring rates during labour and delivery and severe shortage of skilled personnel and equipment for neonatal resuscitation, traditional birth attendance, and mode of delivery related problems which are seen in developing countries in general(74).

In 7.5% of the cases, there was reported home delivery which might be associated with asphyxia. Home delivery also was significantly associated with the prevalence of CP in the current study. Among the CP patients the odd of being home delivered is 10 times greater than institutional delivery, which in turn is associated with many complications. Even though home delivery decreased compared with Ethiopian Demographic Health Survey (EDHS) report of 2011, its effect on maternal and neonatal complication is still high. These observation is in line with a study conducted in China which reported hospital deliveries decrease the risk of developing CP. Home deliveries are likely to have higher risks because they are mostly performed by untrained birth attendants (75).

The other important factor associated with the prevalence of CP was preterm delivery. According to the CDC, being preterm and LBW accounts for 17% of infant death, and it is also one of factors that cause CP. Among the CP patients the odds of being preterm is 3.4 times higher than terms babies. This finding goes in accordance with different studies done in developing and developed countries (66, 69, 76). Infants born prematurely face a number of challenges. Their bodies and nervous systems may not have fully developed, which can cause complications such as breathing problems. In addition, the mother's womb shields the foetus

from infections and various abnormalities; premature birth removes these protections and that's why most of the researches conducted propose infection theory as one of causation for CP.

Improvement in Neonatal Intensive Care Unit (NICU) increased the survival rate of CP so it will increase the overall number of CP mostly in the developed world. And also some studies report in the contrary, being preterm as protective factor like Chinese research (76).

In the present study, null parity was found to be significantly associated with CP. Swedish research reported CP to be more prevalent in high parity and null parity, but did not found association between CP and parity.

There were also other factors which were associated with CP in univariate analysis such as ANC visit, previous birth, maternal chronic disease, preeclampsia, complication during birth, infection during neonatal period. But not associated in multivariate analysis in this study.

In the present study, spastic CP was the most prevalent type and quadriplegic spastic CP had a prevalence of 62.5%. Of the 144 CP patients 128(88.9%) were spastic and 42(32.8%) were level 5, which was consistent with other published data. The dominance of the spastic type of CP was also reported in Iranian and Nigerian studies. Hospital based studies demonstrated higher rates of spastic quadriplegic CP in low income setting countries(64, 77). Which might be attributed to lack of high quality NICU and physical therapy and rehabilitation program is also not that much practiced in developing countries (26)

The most frequently assigned Gross Motor Functional Classification System (GMFCS) category in this study was level V (29.9%).Similarly study done in Ibadan, Nigeria in 2016 showed that two-thirds of the children had severe functional impairment in GMFCS classes IV and V(78). In contrary most frequently assigned GMFCS category in developed nations (US) is level I. This difference in severity level between developing and developed countries might be due to better NICU and delivery service, early diagnosis, and increased quality in management in pre and postnatal care in developed countries(64).

Similarly this study reported MRI findings which goes in line with other studies(79), PWMI being the commonest(comprising PVL and IVH) followed by PGMI. Miscellaneous and mal-development was also observed in some of the MRI. As in the case of other literatures, PWMI indicates early third trimester insult to the brain and PGMI indicates late third trimester insult and malformation shows first and second trimester insult to the brain(80).

In the present study, among all the factors, the most significant ones were perinatal factors, because perinatal factors are comprised of asphyxia, home delivery and preterm which affected the prevalence of CP.

7. Conclusion

The prevalence of CP is low compared to that reported in most African countries. Most of the MRI among the CP report showed PWMI, among them PVL was the commonest. Majority of the CP were spastic type and based on topography most of them were quadriplegic. On GMFCS scale majority of the CP were on level 5. Sex of the child, preterm delivery, home delivery, birth asphyxia and null parity significantly affected the prevalence of CP. Most of the significant factors were perinatal factors. Perinatal factors are preventable problems which can be reduced by decreasing complication during birth, better health care during delivery and postnatal period is mandatory.

8. Limitation and strength of the study

- ✓ To collect data ODK and large sample size was used which will increase data quality in different ways **(strength)**

Limitation

- ❖ The research attempted to capture children with cerebral palsy coming into contact with the health care system, so mild cases might be missed in the middle,
- ❖ our sample is only representative of children with cerebral palsy receiving health care services, so it's better to perform community-based sampling to capture a more representative sampling since no study done in the country
- ❖ Some variables related to the prenatal and perinatal periods, that are known risk factors according to literature, were not included since they are not present in the records.
- ❖ Secondary data were used so some variables will be difficult to assess and removed from the questionnaire.

9. Recommendation

- ✓ **Researchers** need to further explore the:
  - Factors associated since cause and effect relation can't be established in this study
  - By using different research designs and settings other researches should be carried out
  - Conduct research on the CP related outcomes, CP related cost, parental stigma, complication associated.
  - It is also recommended to repeat the research at population level
- ✓ **To health sectors**- more emphasis should be given in delivery room to decrease birth Asphyxia, adequately train health staff
  - ❖ Creating awareness in the community and during ANC
  - ❖ Improved NICU service and equipment's should be given priority to decrease different complications
- ✓ **Ministry of health (MOH)** and other stakeholders should continue the current effort to increase institutional based delivery, access to free service for institutional delivery
  - ❖ Since major focus in Africa in general is infectious disease not much focus was given to disability considering the prevalence.
  - ❖ Different organizations needs to stretch out their hands for the patients and also different hospitals need to link with each other to extend the effort for treatment and rehabilitation.

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Annexes

Annex 1. Information sheet

Title of the project: Prevalence of Cerebral Palsy and Anatomical Findings on MRI at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia

Name of Principal Investigator: Fikreselam Labena

Name of sponsor: Addis Abeba University

This information sheet is prepared for Tikur Anbessa Specialized Hospital of orthopedic patients who will be involved in project entitled above.

Annex 2. Check List

Patient ID----------

Sr.No	Questions	Respond and coding	Remark
Section 1:Socio demographic			
101	Age	1.0-2 years 2.3-6 years 3.7-12 years 4.13-18 years 5.19 and above	
102	Sex	1.Male 2. Female	
103	Education status	1.No formal school 2.less than primary school 3. primary school completed 4.secondary school completed 5.collage/university 6.other	
104	Address	1.Addis Abeba 2.Oromia 3.Amhara 4.SNNPR 5.Dire Dawa 6.Gambella 7.Afar 8.Somale 9.Tigray 10.Harari 11.Sidama	
105	Place of residence	1.Urban 2. Rural	
Section 2:assessment of CP			
201	Documented CP diagnosis	1.yes	

		2.no	
202	If yes CP Motor type	1.spastic 2.dyskinetic 3.ataxic 4.hpotonia 5.mixed	
203	Topographic pattern of CP	1.hemiplagia 2.diplegia 3.triplagia 4.quadriplagia	
204	GMFCS levelling (severity status)	1.level 1 2.level 2 3.level 3 4.level 4 5.level 5	
205	Co-occurring complications	1.autism 2.epilepsy 3.auditory problem 4.visual problem 5.GI problems 6.sleeping problem 7.malnutrition 8.premature ageing 9.others	
Section 3:MRI related			
301	MRI findings	1.malformation 2.predominent WMI 3.predominent GMI 4.miscellaneous 5.normal	
Section 4: pregnancy and birth related for mother and baby			
401	Maternal age	----------	
402	Previous birth	1.yes 2.no	
403	Twin/multiple birth	1.yes 2.no	
404	Infection during pregnancy	1.yes 2.no	
405	Complication during pregnancy	1.hyperemesis gravidarum 2.placenta previa 3.preclampsia 4.gestational diabetes 5.others	
406	Weight at birth of baby	----------in gms.	
407	Birth classification	1.preterm 2.term 3.postterm	
408	Type of delivery	1.instrumental 2.ceserean section	

		3.breech delivery 4.normal delivery without complication 5.normal delivery with complication 6. other	
409	Sign of infection during neonatal period	1.Yes 2. No	
410	Was the baby had asphyxia	1.yes 2. no	

Annex 3.DECLARATION

ASSURANCE OF PRINCIPAL INVESTIGATORS

I, the undersigned, declare that this postgraduate degree proposal is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

1. Name of the student----------signature----------

Date----------

APPROVAL OF THE FIRST ADVISOR

Name of the first advisor----------signature----------

Date----------

APPROVAL OF THE SECOND ADVISOR

Name of the first advisor----------signature----------

Date ----------

APPROVAL OF INTERNAL EXAMINER

Name: ----------

Signature---------- Date. ----------