"COMPARATIVE STUDY OF CLINICAL EFFICACY OF TOLPERISONE VS BACLOFEN IN TREATING SPASTICITY IN CHILDREN WITH CEREBRAL PALSY: A ONE YEAR RANDOMIZED CONTROLLED TRIAL".

BY

(REG NO.BM0118001)

Dissertation

Submitted to the
KLE Academy of Higher Education and Research,Belagavi, Karnataka
In Partial Fulfillmentof the requirements for the degree of

M. D. (Doctor of Medicine)

IN

PAEDIATRICS

DEPARTMENT OF PEDIATRICS,
JAWAHARLAL NEHRU MEDICAL COLLEGE
BELAGAVI, KARNATAKA

APRIL - 2021

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,

BELAGAVI, KARNATAKA

Endorsement by the HOD, Principal/Head of the Institution

This is to certify that the dissertation entitled **"COMPARATIVE STUDY OF CLINICAL EFFICACY OF TOLPERISONE VS BACLOFEN IN TREATING SPASTICITY IN CHILDREN WITH CEREBRAL PALSY: A ONE YEAR RANDOMIZED CONTROLLED TRIAL"** is a bonafide research work done by **(REG NO.BM0118001).**

Dr. MAHANTESH V PATIL **M.D.**
Professor &Head,
Department of Paediatrics,
J. N. Medical College,
Nehru Nagar,
Belagavi-590010
Date:
Place: Belagavi.

Dr.N.S.MAHANTASHETTI **M.D.,**
Principal
J.N.Medical College,
Nehru Nagar,
Belagavi-590010.

Date:
Place: Belagavi.

PLAGIARISM ACCEPTANCE LETTER

KLE

JAWAHARLAL NEHRU MEDICAL COLLEGE

(Recognized by Medical Council of India, New Delhi)

Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)

Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

0831 - 2471350 0831 - 2470759 www.jnmc.edu principal@jnmc.edu

Ref No: MDC/PG/ Date: 16-09-2020

ACCEPTANCE LETTER

The softcopy of thesis entitled: **"COMPARATIVE STUDY OF CLINICAL EFFICACY OF TOLPERISONE VS BACLOFEN IN TREATING SPASTICITY IN CHILDREN WITH CEREBRAL PALSY : A 1 YEAR RANDOMIZED CONTROLLED TRIAL AT KLES DR PRABHAKAR KORE CHARITABLE HOSPITAL,BELGAUM."** has been submitted for Anti-Plagiarism check through Turnitin software. The scan has been carried out and the scanned output reveals a match percentage of **04%** which is within the acceptable limits of **10%** as per the guidelines given by UGC.

Dr. (Mrs.) N.S. Mahantashetti.
Chairperson-Antiplagiarism Committee &
Principal,
J. N. Medical College, Belagavi.

KAHER BELAGAVI J.N. MEDICAL COLLEGE

To,
Reg. No. BM0118001.
Postgraduate Student,
2018-19 Batch,
Department of Pediatrics,
J. N. Medical College, Belagavi.

LIST OF ABBREVIATIONS USED

CP	Cerebral palsy
WHO	World Health Organisation
GABA	Gamma Amino butyric Acid
CNS	Central Nervous System
GMFCS E and R	Gross Motor Function Classification System ,Expanded and Revised
MACS	Manual Ability Classification System
CFCS	Communicating Function Classification System
MAS	Modified Ashworth Scaling
MRI	Magnetic Resonance Sonography
EEG	Electroencephalogram
GMFM	Gross Motor Function Measures
QUEST	Quality of Upper Extremity Skill Test
PDMA-FM	Peabody Developmental Motor Scale
LAQ-CP	Lifestyle assessment questionnaire Cerebral palsy
IAP	Indian Academy of Paediatrics
QOL	Quality Of Life
PEDI	Paediatric Evaluation of Disability Inventory

PedsQL	Paediatric Quality of Life Inventory
TACQOL	TNO-AZL Children's Health Related Quality of Life
PT and OT	Physiotherapy and Occupational Therapy
CIMT	Constraint Induced Movement Therapy
SDR	Selective Dorsal Rhizotomy
AFO	Ankle Foot Orthoses
CDC	Child Developmental Clinic
NICU	Neonatal Intensive Care Unit
PROM	Premature Rupture of Membrane
HAT	Hypertonia Assessment Tool
DQ/IQ	Developmental Quotient/ Intelligent Quotient
SCPE	Surveillance for Cerebral Palsy in Europe
LBW	Low Birth Weight
SGA	Small for Gestational Age

ABSTRACT:

Comparative study of clinical efficacy of tolperisonevs baclofen in treating spasticity in children with cerebral palsy: a one year randomized controlled trial.

INTRODUCTION: Spastic cerebral palsy is the most common type and its medical management with baclofen has many side effects. Hence there is need for other drugs in management of spastic cerebral palsy. Tolperisone which is centrally acting drug has been shown to reduce spasticity in adults. However there are not much studies on use of tolperisone in children with spastic cerebral palsy.

METHODS: A Randomised controlled trial, where 60 children with spastic cerebral palsy(predominantly spastic/mixed cerebral palsy) were enrolled over a period of one year from march 2019 to march 2020. Were randomised to receive either baclofen (1mg/kg/day) or tolperisone(4-5mg/kg/day). Efficacy of the drugs was assessed using Modified Ashworth Scaling, Quality of Upper Extremity Skill Test, Gross Motor Function Measures, and Lifestyle Assessment Questionnaire at baseline and 3 months post intervention.

RESULTS: Mean age was 4.06 years in baclofen and 3.86 years in tolperisone group with M:F ratio= 1.4:1.Both the groups were comparable with regards with to co-morbidities, birth factor and Gross Motor Function Measures classification. Both the groups showed improvement in MAS,QUEST and GMFM score after 3 months, the effect of tolperisone was comparable with baclofen with p value of>0.05. MAS score of Quadriceps, Baclofen group (pre-intervention-2.41±0.50 and post- 2.25±0.44) was comparable with scores in tolperisone (pre-intervention - 2.46±0.5 and post-2.08±0.27). QUEST total, Baclofen (pre-51.27±21.07 and post 52.71±21.46.) was

comparable with scores in tolperisone (pre-46.8±18.40 and post-59.60±17.61). GMFM, baclofen (pre-49±22.43 and post 50.48±22.13) was comparable with scores in tolperisone (pre-42.06±20.84 and post-47.45±20.07).There was no improvement seen in LAQ CP in both the.28(93.3%) of the patient with baclofen had side effects whereas only 18(30%) had in tolperisone. The cost of tolperisone was half of cost in tolperisone.

CONCLUSION: Both baclofen and tolperisone were effective in reducing the spasticity in cerebral palsy and benefits were comparable. Tolperisone is cheaper and well tolerated better alternative to the baclofen.

Key words: Spastic cerebral palsy, Spasticity, Baclofen and Tolperisone

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Cerebral palsy is "a heterogeneous group of permanent disorders of movement and posture, causing activity limitation that are attributed to non-progressive disturbances of the developing fetal or infant brain"[1]. Mostly CP has motor disturbances but is accompanied by co morbidities like problems in Sensory perception, cognition, psychological and behavioral disturbances, seizures and secondary musculo-skeletal problems resulting in significant effect on the quality of life[1].

Worldwide prevalence of cerebral palsy is 1-4 per 1000 live births, 1 in every 323 children. In India, no absolute figures are available, but estimated children affected are over 2.5 million. There has been apparent increase in number of CP amongst neonatal survivor. Almost 15-20% of physically disabled children are categorized under cerebral palsy[2, 3].Prematurity is one of the important causes of CP. A Sweden study on 241 children showed that CP occurred in 36% of babies born <28 weeks and 37% in term babies.

A Scandinavian study reported that in topographical classification diplegic CP is commonest with 44% cases. Amongst 4 major physiological classification of cerebral palsy, spastic cerebral palsy is the most common type[4, 5, 6]. The most common clinical presentation of cerebral palsy is spasticity[7]. A study by Beckung. E. et all on children with CP in the age group of 1-15 years showed that 90% of children with CP will present mainly with spasticity[8]. Quality of daily living is affected due to spasticity as it affects patient's independence in terms of maintaining hygiene, dressing and self ambulation[9, 10]. Children with spastic cerebral palsy mainly present

with hypertonia of muscle leading to motor impairment, contractures and bony deformities.

Spasticity treatment is important for life quality improvement and reduces complication. A variety of treatment options are available for spasticity including non medical options such as physiotherapy, occupational therapy and complementary and medical treatment in terms of anti spastic drugs[11].No definitive treatment exists for children or adults with CP. Conventional treatment mainly helps to influence the development of postural control, muscle tone and reflex activity by a combination of body positioning, active exercises and prevention of posture which enhances tonal and reflex abnormality[7]. The treatment should be individualized according to each patient's clinical condition and severity.

One such interventional therapy is use of oral medications like centrally acting drugs like Baclofen a GABA agonist, Alpha 2 agonists such as clonidine, tizanidine, benzodiazepines like diazepam, gabapentin and drugs with peripheral mechanism of action which includes dantrolene sodium. Evidences on oral baclofen as reducing the muscle tone, improving motor function is conflicting and this is shown in Cochrane handbook for systemic reviews[11]. A study by Goyal. V. et al showed no difference in the effectiveness of baclofen in comparison with tolperisone in reducing spasticity[12].

A study by Alper I. et al showed a maximum adverse effect with significant p value in the group treated with baclofen when compared to group treated with tizanidine[13]. So even though baclofen is most widely used drug the effectiveness of it is inconclusive and has maximum adverse effects. Hence, there is scope for use and evaluation of new drugs with better efficacy and less adverse effect in spasticity treatment.

From last few decades a new muscle relaxant which is centrally acting Tolperisone is in use in various parts of Europe and Asia. It's a piperdine derivative and action is by inhibition of pathologic mono and polysynaptic reflex activity in formation reticularis and spinal cord there by stabilizes the nerve membrane[7]. There are no sedative or with-drawal effects due to absence of substantial affinity of drug to adrenergic, cholinergic, dopaminergic or serotonergic receptors in CNS. A study by Rao R[14] et al in patients showed that on comparison of Tolperisone with thiocolchiocoside, the former showed better efficacy in 89.9% patients in patients with spasticity due to injury of spinal cord.

A study by Agarwal S et al showed a 58.67% improvement in functional out come in baclofen group when compared to 94.6% improvement in tolperisone and adverse events were seen in 14 patients in baclofen group and 32 patients in tolperisone group. But this trial included both adult and children with spasticity secondary to stroke or cerebral palsy. This was the only study conducted in India on Tolperisone[7].

The main aim of our study is to fill the gap in the knowledge regarding the efficacy of tolperisone when compared to most commonly used anti spastic drug, Baclofen and also to know the tolerance of tolperisone in children with spastic cerebral palsy.

OBJECTIVE OF THE STUDY

PRIMARY OBJECTIVE:

- To study the clinical efficacy of Tolperisone in comparison to Baclofen in reducing the spasticity in cerebral palsy children with age more than one year.

SECONDARY OBJECTIVE:

- To assess the adverse effects associated with the Baclofen or Tolperisone.

REVIEW OF LITERATURE

HISTORY

Cerebral means "of, or pertaining to, the cerebrum or the brain" and palsy means "paralysis generally partial, where by a local body area is incapable of voluntary movement"[15].

The ancient Indian physician Susrutha, in his compendium wrote about *ritu* (time of conception), *kshetra* (Uterus), *ambu* (Amniotic fluid) and *beeja* (sperm and ovum)as the causes leading to Cerebral palsy[16]. Another ancient Indian text, Charakas Samhita, mentions about *Garbho paghata karabhava* which means factors associated with fetal development, *Garbha Vriddhi karabhava* meaning the monthly fetal development and *Garbhini Paricharya*, the do's and dont's of a pregnancy, as some of the causes for deformities in an infant, there by shedding light on the understanding of these diseases by our fore fathers[17].

The modern understanding of cerebral palsy as a problem due to brain damage began in early decades of 1800[15].

William Charles Ollivier in 1827 first described about the immature fetal brain and Liquefaction. Bednar spoke about periventricular leukomalacia in 1851[15].

According to historical documents, Dr. John Little is recognized as the first person to study cerebral palsy and define it in 1853[16].

In 1830, Dr Little's work began on cerebral palsy where is tried to correlate oxygen loss and brain damage leading to cerebral palsy[16].

"On the Nature and Treatment of the Deformities of the Human Frame" was an important course of lecture on CP delivered by Dr Little at Royal Orthopedic Hospital in 1843[16].

Historically, cerebral palsy was simply called "Little's Disease," named after Dr. Little[16].

Sir William Osler in 1887 coined cerebral palsy who wrote a book entitled, "Cerebral Palsies of Children." [16].

Dr. Sigmund Freud, a renowned psychiatrist, along with a neurologist, described the connection between development of disorder and the prenatal cause[15, 18].

The idea of cerebral palsy due to abnormal brain development before birth was first told by Dr Sigmund Freud. This concept by Freud that oxygen deprivation is not only the cause of CP was contradicting the statement by Dr Little who always explained Birth asphyxia as the cause of CP[15, 18].

Freud based his theory that some children that experienced oxygen loss during Childbirth might not be affected by it, while others were. Little, on the other hand, had always maintained that birth asphyxia was the cause of cerebral palsy[15, 18].

This concept changed years later where after extensive research it was shown that birth asphyxia accounts to only 10% cases of CP[18].

Other contributions, Leonard and Isabelle Golden son, co-founded the United Cerebral Palsy Association in 1950 in remembrance of their daughter who was diagnosed with CP and died at 9 years due to complications. Today, the United

Cerebral Palsy Association is the 5th largest health organization in the United States[19].

An Orthopaedic surgeon Winthrop Phelps was the first one to treat CP, he Viewed it as a musculoskeletal problem rather that a neurological and did Surgery for problems of spasticity and contractures. A physical rehabilitation Practitioner Andras developed a system to teach children with CP how to walk and perform other basic movements and this has become the foundation for conductive education and is widely used till date[15].

DEFINITION

Disabled children are a great concern to a family and also to the society. About quarter of chronic childhood problems are neurological and in that cerebral palsy forms the major part making the affected both physically and mentally challenged[15].

Cerebral palsy is a collective term used to describe the disorder affecting the posture, movement and balance. In 1959, Mac Keith and Polani from Little club defined CP as "a persisting but not unchanging disorder of movement and posture, appearing in the early years of life and due to a non progressive disorder of the brain, the result of interference during its development"[20].

In 1964, Bax and his group in an effort to put forth a universally acceptable definition, successfully stated CP as "a disorder of movement and posture due to a defect or lesion of the immature brain.''[21].

In the early half of 1990's, after understanding the concepts of pathology in early brain damage and complexities of disorders under CP, Mutch and colleagues

reiterated the emphasis on motor involvement and non-progressive nature of disorder as annotated previously by modifying the definition as, ‘‘an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of development’’[22].

International Workshop was held in 2004 for defining and classifying Cerebral palsy. They published the definition in 2006 report and defined it as follows. “Cerebral palsy (CP) describes 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 fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior; by epilepsy, and by secondary musculoskeletal problems.” [23].

This definition shows that cerebral palsy is not one particular disease, is associated with varied co-morbidities and the disease requires multi-disciplinary approach for treatment.

EPIDEMIOLOGY

According to WHO estimation, the global prevalence of disability stands at 15%, with those individuals suffering from some or the other form of disability24. In India 3.8% of the population suffers from disabilities[3]. Cerebral palsy is commonest disabling illness of the childhood. The prevalence of Cerebral palsy is 2-3 for every 1000 live births globally[24]. Cerebral palsy prevalence on the whole has not changed over the years despite the advancement in perinatal medicine due to increased survival

of preterm babies[25]. The prevalence in developed countries is 2.11 for every 1000 live births, and 2.0 to 2.8 in middle and low income countries [26, 27].With 17 million individuals affected worldwide, the incidence and prevalence differs across countries based on prenatal care and intranatal and postnatal medical facilities available [28]. Though robust data is lacking from our country, the prevalence is estimated at 3/1000 live births and there are about 25 lakh individuals living with cerebral palsy as per the recent statistics[23].

RISK FACTORS:

Birth asphyxia or difficult labour has always been perceived as a foremost reason of cerebral palsy. But disproving this common belief, studies have found perinatal asphyxia to be causative factor for only 10% of cerebral palsy cases [29]. Post natal events such as infections, stroke, hypoglycemia and trauma, which were recent attributions to the etiology of Cerebral palsy, accounted for 10% of the cases[25.] The majority i.e., in around 80% of the cause of Cerebral palsy are believed to be intra-uterine events, such as chorioamnionitis, prematurity, genetic factor etc.

The following table depicts the Causative/Risk factors for CP[30-35].

TABLE NO 1

Prenatal accounts for 80%
• Premature birth • Small for gestational age or low birth weight. • Intra Uterine Growth Restriction • Multiple births • Intracranial Hemorrhage, White matter injury, Periventricular leukomalacia • Elderly mother • Maternal hypotension, Sepsis, Diabetes Mellitus • Severe maternal Iodine deficiency • Intra uterine infections like TORCH group • Genetic defects o LIS1 genetic mutation- Lissencephaly o GPR56 gene – Polymicrogyria o COL4A1 genetic mutations – porencephalic cysts, schizencephaly
Perinatal causes accounts for 10%
• Perinatal asphyxia • Maternal infections • Stroke • Hyperbilirubinemia leading to kernicterus • Hypoglycemia, Dys-electrolytemia • Septicemia
Postnatal Causes accounts for 10%
• Meningitis / Meningoencephalitis or other febrile encephalopathies • Stroke • Head trauma • Hypoxic events

Disturbances in the fetus before 20 weeks gestation, due to maternal infections or recently identified genetic defects which lead to brain malformations by neuronal migration abnormalities, lead to severe phenotype of CP causing spasticity and dystonia. [30,35].

Disturbances to the growing fetal brain between 24-32 weeks periods of gestation, lead to injury of periventricular white matter due to its vulnerable blood supply. This leads to characteristic spastic diplegia presentation owing to the representation of legs on the homunculus on periventricular cortex. Prematurity and LBW have been attributed as one of major causes of Cerebral palsy, where the prevalence is as high as 40 to 100 for every 1000 live births and the risk is 70 fold high if the birth weight is lesser than 1.5kgs. [24,37,38 .]

Intra partum damage to the brain commonly affects the highly metabolic areas such as basal ganglia due to the vigorous vascular development. This usually leads to dyskinetic type of CP. But, if the damage is extensive, can also present as spastic and dyskinetic variant.[24]

Strokes usually present with unilateral involvement as middle cerebral artery territory is usually involved, with arms being affected more than the legs.[39]

CLASSIFICATION OF CEREBRAL PALSY[17]

A.QUALITY OF MOTOR IMPAIREMENT

1. Pyramidal - Spastic CP(most common)
2. Extra pyramidal – Dyskinetic or mixed.

B. TOPOGRAPHICAL CLASSIFICATION

1. Spastic hemiplegia (20-30%) – Spasticity predominantly involving one half of the body, including arm and a leg.

2. Spastic diplegia (30-40%) –Spasticity predominantly involving bilateral lower limbs than upper limbs and sometimes only lower limb is involved.

3. Spastic quadriplegia (10-15%) – All four limbs and trunk are involved.

4. Dyskinetic cerebral palsy – presence of extrapyramidal signs in form of abnormal movements (athetoid, choreoathetoid and dystonic), hyper tonicity is usually present.

5. Monoplegia – Rare, involvement in only 1 limb and here other causes of monoplegia should be ruled out other than cerebral palsy.

6. Double hemiplegia – upper limbs are predominantly involved than lower limbs.

C. FUNCTIONAL CLASSIFICATION

1. GMFCS (according to different ages)[40]

The GMFCS levels tell about the CP child's daily activities and amount of social participation.

GMFCS levels at given time can show the future predictive functional changes of the child.

It helps in decision-making and parental counseling is whether children with CP can maintain the same level of competence or be reclassified to different levels over time.

Palisano. et al, described first that GMFCS provides a five level, ordinal grading system for easy, quick and meaningful assessment of gross motor function in cerebral palsy patient. GMFCS describes self initiated movements and about the use of assistive devices like walkers, canes and wheelchairs) for mobility in usual activity.

This initially started for 2-12 years. Later in 2007 it was extended to include 12-18years and also differentiation between the levels also was increased taking developmental milestones in to account.

Different GMFCS scales are available for different ages 2-4 years,4-6 years,6-12 years and >12years and GMFCS done at 12 years are highly predictive of adult motor

GMFCS score for 6-12 year

"Level I: walks without any limitations

Level II: Walks without assistive devices, but with limitations (ex: limitations in walking long distances, stairs and balancing)

Level III: Walks using a hand held mobility device (ex: crutch or walker)

Level IV: limited self mobility; child uses powered mobility device independently (ex: a joystick operable wheel chair)

Level V: Child transported in a manual wheel chair. Has severe activity limitations"

2. MACS(manual ability classification system)

In 2006 Eliasson et al. developed a scale called Manual Ability Classification System (MACS) for evaluation of upper extremity function.

The MACS is a, five-point ordinal classification system, designed for use in children aged 4–18 years[40].

"Level 1 - handles object easily and successfully Level 2 - handles most objects but with somewhat reduced quality or speed of achievements Level 3 – handles objects with difficulty; needs help to prepare or modify activity Level 4 – handles a limited selection of easily managed objects in adapted situations Level 5 – does not handle objects and has severely limited ability to perform even simple actions".

3. CFCS (communicating function classification system) [40].

According to World Health Organization's International Classification of Functioning, Disability and Health (ICF), the Gross Motor Function Classification System (GMFCS) and the Manual Ability Classification System (MACS) make it possible to classify mobility and handling objects respectively. However 31%-88% of CP patients face problems with communication, a study in Norwegian showed that 19% of CP patients had no speech and addressing this at treatment level is very important and hence CFCS was developed to assess the overall communication development. It includes five levels according to the effectiveness of communication.

Spastic diplegia is most common type of cerebral palsy accounting for 30-40%, diplegia means weakness of all for limbs but lower limbs are weaker than the upper limb. Peri-ventricular leukomalacia is the most common etiology of spastic diplegia in child born prematurely. The peri-ventricular white matter area represents a water shed area in preterm newborns and is vulnerable to hypoxic insults. Children with this type can have normal or hypotonia up to 4 month of age spasticity starts progressively over first year.

Creeping is impossible and the milestones of sitting up alone and getting up is never achieved. When pulled up infants stand rather than sitting. Most of them stand on their toes with flexion of knees and lumbar lardosis. Examination shows increased tendon reflexes of all four limbs and scissoring.

CLINICAL FEATURES

Early recognition of symptoms of cerebral palsy is necessary to intervene at the earliest with interventions, thereby improving the child's activity and participation. Identification of CP is generally made based on clinical features.

Healthy infants from 6 weeks till 20 weeks of age develop small, elegant and transient fidgety movements involving the neck, limbs and trunk. These movements are best seen when an infant is awake, alert in supine or semi reclined position and can be sustained up to as long as an hour. These movements disappear once the child cries or fusses in hunger. In a study by Prechtl HF et al, absence or lack of normal fidgety movements were associated with abnormal neurodevelopment outcome. These features when used along with Magnetic resource imaging of preterm brains have a diagnostic accuracy of 100% in predicting cerebral palsy[41,42].

In a child with CP, the motor disability is a predominant symptom. In most of these children, the motor abnormalities present by or become apparent by 18-24 months of age. Early hints of CP in an infant usually include: [31, 37].

- Delay in motor milestones: probably the most important symptom of CP. Children usually present with delayed milestones
- Tone and Posture: Hypotonia, hypertonia or normal tone can be seen. Lack of head control, floppiness, hand fisting, oro motor pattern abnormalities like tongue thrusting and grimacing, early hand preference (before 15 months), commando crawl, apparent early head control in some cases due to increased axial muscle tone.
- Abnormal Reflexes: exaggeration of neonatal reflexes or delay in their disappearance.
- Abnormal neurobehavioral signs: irritability, lethargy, difficulty to handling, excessive or difficulty in sleeping.

When a child comes with above mentioned signs and symptoms, after a thorough examination and history, imaging studies can be obtained which will aid in the diagnosis. According to American Academy of Neurology, MRI is abnormal in 86% of Cerebral Palsy cases. Before labeling a child as a case of CP, one needs to eliminate the likelihood of progression of symptoms or worsening of existing symptoms, in order not to miss out on diagnoses of neuro-regressive or metabolic disorders.[43]

Following are the major clinical features of CP Syndromes: [31, 44].

TABLE NO 2:

CP Syndromes	Proportion	Causes and Risk factors	Clinical features
Spastic Diplegia	15-25%	• Prematurity • Ischemia, infections • Endocrine causes ↓ • Peri Ventricular Leukomalacia • Periventricular cysts or scars	• Clasp Knife Spasticity. • Brisk Deep tendon reflexes (DTR) • Extensor plantar • Contractures • Commando Crawl • W-sitting • Toe walking • Preserved upper limb function and cognition
Spastic hemiplegia	20-40%	• Term • Thrombophilic disorders • Infection • Genetic causes ↓ • Stroke: in utero or neonatal • Focal infarct or cortical damage • Cortical malformations	• Asymmetrical moro's reflex • Assymetrical hand movements • Early hand dominance (before 12 months) • Reduced muscle bulk on the affected side
Spastic Quadriplegia	20-40%	• Preterm/ Term • Birth asphyxia • Meningitis • Cerebral dysgenesis • Genetic causes • Periventricular leukomalacia • Multicystic encephalomalacia • Cortical malformation	• Severe motor and cognitive delay • Initial months may show hypotonia • Slow evolves into spasticity by 9-12 months • Feeding difficulties • Seizures and chronic respiratory problems are common.

Dyskinetic CP • Dystonic CP • Choreo-athetoid CP	10-15%	 • Perinatal Asphyxia • Term • Severe Hyperbilirubinemia	• Variable tone • Reduced spontaneous movements • Involuntary movements • Drooling • Involuntary grimace • Striatal Toe • Dysarthria • ID • Contractures less common • Dystonia present • Tendon reflex may or may not be present • Chorea and athetoid movements • Athetoid more common.
• Ataxic	5-10%	• No specific aetiology • May be genetic or early prenatal.	• Hypotonia • Delayed milestones • Ataxia • Slow jerky speech.

Spastic diplegia is most common type of cerebral palsy accounting for 30-40%,diplegia means weakness of all for limbs but lower limbs are weaker than the upper limb. Peri-ventricular leukomalacia is the most common cause of spastic diplegia in child born prematurely. The peri-ventricular white matter area represents a water shed area in preterm newborns and is vulnerable to hypoxic insults. Children with this type of cerebral palsy can have normal or hypotonia up to 4 month of age spasticity starts progressively over first year.

Creeping is impossible and the milestones of sitting up alone and getting up is never achieved. When pulled up infants stand rather than sitting. Most of them stand on their toes with flexion of knees and lumbar lardosis. Examination shows increased tendon reflexes of all four limbs and scissoring.

COMORBITIES

As per the current definition of cerebral palsy, almost all the cases of CP are complicated by associated co-morbidities[25.] The following table enlists the common co-morbidities of a Child with CP based on a systematic review by Novak et al: [45]

TABLE NO 3:

Co-morbidity	Remarks
Intellectual disability (ID)	• Seen in 50% patients • Spastic quadriplegics are severely affected
Epilepsy / seizures	• Seen in 25-45% patients • Most common in spastic quadriplegics and hemiplegics. • Children with CP and ID have more possiblity to have epilepsy.
Neurobehavioral disorders	• Occurs in 25% CP children. • Children with CP and ID are prone to have behavioral problems
Visual disorders	• Seen in 30% children with CP. • Commonly associated with Prematurity. • Retinopathy of prematurity, Amblyopia, Refractive errors, strabismus, Myopia is common causes.
Hearing and Speech impairment	• Seen in 30-40% cases • Aphasia or dysarthria are common.
Gastrointestinal disorders	• 90% of the children are associated with GI problems. • Constipation, bulbar palsy causes swallowing difficulties; Gastro-esophageal reflex disease (GERD) and vomiting are commonly seen. • One in fifteen CP children have feeding difficulty.

	• Mostly seen in children with severe physical disability. • Leads to malnutrition and growth failure.
Growth failure	• Poor nutrition and GI difficulties are the causes
Pulmonary disorders	• Recurrent aspiration due to GERD, bony deformities like scoliosis etc are associated with chronic lung diseases
Pain	• 75% children with CP are associated with pain in one or the other form. • Orthopaedic and muscular pains, dental caries, constipation are common causes. • Regardless of severity of disability, these patients are prone to develop pain as per high quality evidence in studies.
Urinary problems	• Up to 60% children with CP can have disturbances in voiding, like enuresis, increased frequency, dribbling etc
Sleep disturbances	• Exact prevalence not known • But seen commonly in CP children.

DIAGNOSIS [46, 47].

Since the first description of cases of CP in the 1800s by William Little lots of argument have been put through for earliest possible diagnosis in order to "promote beneficial treatment of the disorders when detected in the early stages". Following this many developments took place in order to get early diagnosis and early intervention.

In cerebral palsy there is no regression of milestones. In some cases the early hypotonia will change to spasticity or dystonia later by 2-3 years.

The early signs for detection of CP are

- Hand preferences
- Prominent fisting
- Abnormal neonatal reflexes
- Persistence of primitive reflexes
- Abnormalities of tone

As further evaluation, investigations done include

- an EEG if there is history of epilepsy.
- MRI which provides etiology of cerebral palsy
- Metabolic and genetic tests are carried, if regression history is present.
- Test to rule out coagulopathy.

Repeated examinations are required especially in preterm babies for confirmative diagnosis of CP as few postural abnormalities like transient dystonia if present will disappear by one year of age. In clinical examination other than the routine central nervous system examination, few scales are used to assess the severity of condition and these also helps in evaluating the potency of therapy intervention, and should be responsive, reliable and valid[46].

1. Modified Ashworth scale (MAS, score vary between 0-4) is used to estimate the muscle tone and is universally accepted. Spasticity defined by Jim Lance in 1980, "as a velocity-dependent increase in muscle stretch reflexes associated with increased as muscle tone as a component of upper motor neuron syndrome". In 1964, Bryan Ashworth describes the Ashworth Scale as a method of grading spasticity." The original Ashworth scale was a 5 point numerical scale that graded spasticity from 0 to 4, with 0 being no resistance and 4 being a limb rigid in flexion or extension". Bohannon and Smith modified the Ashworth scale by adding 1+ to the scale to increase sensitivity. Since then it is used in clinical practice and research as a measure of spasticity. The scale is as follows [47]:"0: No increase in muscle tone, 1: Slight increase in muscle tone, with a catch and release or minimal resistance at the end of the range of motion when an affected part(s) is moved in flexion or extension, 1+: Slight increase in muscle tone, manifested as a catch, followed by minimal resistance through the remainder (less than half) of the range of motion, 2: A marked increase in muscle tone throughout most of the range of motion, but affected part(s) are still easily moved, 3: Considerable increase in muscle tone, passive movement difficult, 4: Affected part(s) rigid in flexion or extension"

   The disadvantage of MAS is its intra and inter-observer reliability and is an inadequate tool for measuring muscle tone. Advantage is quick to perform and does not require any instruments and is accepted as standard for clinical assessment of extreme spasticity. It is performed mainly by passively stretching the muscle of examination and assessing the tone[47].

2. Gross motor function measures(GMFM, Score 0-100)[48] "The Gross Motor Function Measure (GMFM) is an assessment tool designed to measure changes in gross motor function over the time or to know the therapeutic response in children with cerebral palsy". It was first developed in the late 1980s. Sanders et al reported that "The GMFM often serves as a validation standard for other rehabilitation measures. It has been successfully used to, measure change in effectiveness studies related to physiotherapy and other types of therapy"[13] .The actual version of the GMFM, the GMFM-88, contains 88 items that have been divided into 5 dimensions of gross motor function: "lying and rolling; sitting; crawling and kneeling; standing; and walking, running, and jumping". The GMFM-66 is a 66 item subset of the original 88 items identified through Rasch analysis to best describe the gross motor function of children with cerebral palsy. GMFM 66 is mainly used for CP child and uses 22 items less than GMFM 88.Use of the GMFM-88 is usually used in Down's syndrome and in acquired brain injury. GMFM also helps in estimating the GMFCS class. The GMFM would be appropriate for children whose motor skills were at or below those of a 5-year-old child without any motor disability.

3. QUEST(Quality of upper extremity skills test)[49,50] When looked at the literature regarding the measuring of hand function Parette and Hourcade (1984) reviewed studies and suggested that the evidence to support the effectiveness of therapy is decreased. Martin and Epstein (1976) identified a lack of suitable method and instruments for quantifying motor behavior as a major limitation in attempts to evaluate the efficacy of therapy in CP.

Lundberg (1979) described a procedure for arm and hand function for age group between 1-3 years, but this assessment has not been standardized and norms are not available for other age groups.

Another test used is Peabody Developmental Motor Scales (PDMA-FM), this score was developed to identify the problems in motor skills and can be used to help measure children with disabilities, although their scores cannot be compared to the norms given. But it will not measure the changes in the quality of upper extremity and hand function.

In short, there was no available measures which measure the quality of upper extremity movement in children with CP. Hence the QUEST was developed. “Quality of Upper Extremity Skills Test (QUEST) is a reliable and valid assessment tool that evaluates functional quality of the upper limb in four areas: QUEST A - dissociated movement (shoulder, elbow, wrist, fingers - 32 items), QUEST B - grasp (cube of 2.5 cm, cereals, pencil or pen - 12 items), QUEST C - protective extension (anterior, lateral, posterior - 18 items), QUEST D - weight bearing (in prone, quadruped - 25 items), QUEST evaluates head, trunk and shoulders position during grasp movement, classifying them under normal or atypical”.

Scores were calculated for each subject by adding items that corresponded to them, assigning one point is assigned for every "yes" answer and then it is calculated by adding items. Thus, total and each domain score may range from zero (worst performance) to 100 (best performance).

Compared to total QUEST score the value of each domain shows better evaluation of upper extremity and it was also reported by Thorley, et al.[50], in a previous study with 94 Australian children, that the upper limb impairment in each evaluated domain had better understanding than in the total QUEST score.

The average time for evaluation is 30 minutes in most compromised children and 20 minutes in less compromised[50].

4. Lifestyle assessment questionnaire(LAQ-CP) measures at a given point of time the impact of disabilities on the lives of children with cerebral palsy and their family, as perceived by the child's parents or career. Limitation include LAQ is only validated as a descriptive/discriminative tool. It is able to discern variation between individual children at a given point of time .LAQ is an ideal tool for use with cerebral palsy register and is now used routinely to collect data and most of the validation is done for the age group of 3-10 years and should not be used out of this range. It allows greater precision in assessing population health care needs [52.]

World Health Organization Quality of Life Assessment Group defined quality of life (QoL) as "an individual's subjective perception of their satisfaction across various domains in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns". QoL in particular is one of the most important methods of quantification of the impact of these interventions as ultimately it is the improvement in quality of life is what both the patients and care givers strive for.[53]

QoL is multidimensional and the components vary as per the variables desired. Various researchers have used different components over the years. In 2002, Stewart proposed that "QoL should be defined in terms of five domains, namely material well-being, health, education and literacy, participation in the productive and social sphere; whereas Pollard & Lee in 2003 defined QoL in another five different domains of well-being: physical, psychological, cognitive, social and economic". There has been a surge in usage of QoL based assessment in the recent years as it is a practical indicator of the impact of interventions and helps in prioritizing the health related issues and monitoring the changes[53-56].

Various QoLs have been used in the past by researches to assess the impact of interventions in CP children like-"Pediatric Evaluation of Disability Inventory (PEDI) [53, 57], Pediatric Quality of Life Inventory (PedsQL) [58], TNO-AZL Children's Health-Related Quality of Life (TACQOL) scale[59.],the Caregiver Priorities and Child Health Index of Life with Disabilities[60],the Life style assessment Questionnaire-CP (LAQ CP)[61]".

In 2009, Hoving and colleagues reported using a child health questionnaire that baclofen treatment had improvement in psychosocial domain of the QoL. Using exercise training program as the intervention, improvements were found in motor domain of TAC QoL. Stiller in 2003, assessing the behavioral aspect of interventions using PEDI score, found that the group using intensive combination therapy had better impact than the group using conducive therapy alone as intervention[62,63,64]

Many researches have quantified individual interventions in terms of QoL improvement but no study has quantified the improvement of child's Quality of life after subjecting them to a set of standard and systematic interventions. Among the

many questionnaire's available for QoL assessment the LAQ-CP was validated for Indian population in Delhi [64,66.]

Management of cerebral palsy:

CP has long been perceived as an untreatable disease. Though not curable, the symptoms and co-morbidities can be mitigated there by improving the quality of life of these children. Managing a case of cerebral palsy is a huge task to a paediatrician as it involves not only treating the child, but also alleviates the undue stress borne by the families and caregivers. Also, the wide spectrum of symptoms and co-morbidities associated with CP, mandate a multi-disciplinary approach in its management[67.]

The treatment strategy depends on degree of functional failure caused by spasticity and its location. Various approaches are available for overall improvement in the living of children with cerebral palsy and parents or caregivers plays an important role[68.]

The management of CP child has had a philosophical shift over the years. WHO's international classification of functioning, disability and health, has been instrumental in changing the view and approach of clinicians in treating Cerebral palsy. Cerebral palsy affects the body structure and function, activity and as well as participation. Traditional management goals in CP were more towards addressing the structural abnormalities but currently, the focus is mainly on maximizing the child's environment by activity improvement and enhancing their participation in the community. Evidence has shown the benefits of family-centered services in treatment and approach to a case of CP, focusing on the goals of child and caregivers and not just from a clinician's perspective. Family centered approach is also unique in a way

that it respects the needs and wishes of each family and transcends the boundaries of different cultures and it also lays emphasis on the fact that a family is the constant unit of context for an individual with disability[69, 70,71,72,73].

Historically, CP has always been considered as a disease of childhood. But with improving medical facilities and rehabilitation therapies, the number of individuals with CP living into adulthood has substantially increased in the recent past. But at the same time, the training and orientation of internal physicians and surgeons who deal with adult patients has not been evolved to accommodate CP as a disease transcending into adulthood. Many a time patients and their caregivers also are more comfortable visiting the treating pediatricians rather than physicians way into the adulthood.[71, 74]

The goal of any intervention should be to modify the course of disease. Novak et al, in their exhaustive review, opined that among 64 intervention techniques, 24% were effective, 70% were still uncertain regarding the outcomes and 6% were ineffective. Physical therapy, occupational therapy and medicines were the most effective of the interventions. Psychology, speech therapy social work and education etc had a low quality of evidence for effectiveness. Though most of these interventions focused at the level of body functions and activity but not participation of the above mentioned WHO classification of functioning, disability and health, lack of evidence in this context doesn't mean they offer no benefit. But it should also be borne in mind that it is ultimately both activity and participation that impact the quality of life of these patients[75.]

To summarize, the interventions used should affect the following

- To correct tone and posture.
- Improve mobility
- Focus on mitigating co-morbidities
- To improve care given to the child
- Improve quality of life
- Provide comfort to the child and family
- Make the child as self-sufficient as possible.

The factors to be considered before initiating the treatment are:

- Goals and expectations of patient and family and not just of clinician.
- The age of the patient
- Financial status
- Willingness for regular follow up and compliance.

Management of Motor impairments:

Before beginning the treatment modalities to correct tone of patient, it is important to evaluate the usefulness of tone, as hypertonia sometimes is beneficial. In a child with severe hypotonia in lower extremities, increase in central tone will help him to stand up on his feet and reducing tone in this patient may pose a negative effect. Broadly speaking, the aims of tone reducing treatment should be, to ease and maximize patient's functions and reduce the complications like pain, contractures, dislocations and subluxations. It is also prudent to always have a discussion with the family members before initiating any intervention and during the treatment in order to

have realistic and attainable goals and to curtail any over expectations from the care givers or family members[76.]

Physiotherapy (PT) and Occupational therapy (OT):

It is a part of CP management ranging from simple exercises to electrical stimulation. Although many modalities under PT lack conclusive evidence, they aid in helping the caregivers to learn how to best handle, wash, toilet and feed their children with CP and improve their posture and optimize the tone and mobility.

Among the various modalities, the ones with conclusive evidence include:

- Bimanual training for hemiplegic CP: here patients are trained to use both the hands to improve functioning[77, 78, 79].
- Constraint induced movement therapy (CIMT): unaffected limb usage is reduced in order to improve the function of affected side. Used in hemiplegics[80, 81].
- Context focused therapy: here the environment or task is changed to promote successful task performance [82.]
- Goal directed functional training: improved gross motor function[83, 84.]
- Strength training: use of challenging resistance to muscle contraction with progressively increasing resistance[85, 86, 87.]
- Stretching: used for contracture prevention[88.]

Among those with ineffective evidence for improvement include:

- Hydrotherapy: aquatic based exercises to improve gross motor activities.[89,90]
- Neurodevelopmental therapy: direct, passive handling to optimize the functions. Used to prevent contractures, normalize the movements, enhances social and cognitive functions[91, 92..]
- Electrical stimulation: stimulation of muscles through skin electrode to produce passive contraction to improve gait and muscle strength[93, 94, 95].

Feeding and nutrition:

- Feeding difficulties that arise due to bulbar/pseudo bulbar palsy and dyskinesia are usually treated with oromotor exercises but the evidence for these interventions is of low quality. Sensory stimulation is given to jaw, lips, tongue, larynx, soft palate[96].
- Gastrostomy will be needed in few patients with severe swallowing difficulties with inability to swallow food or water for 6 weeks, recurrent aspiration pneumonias etc. Adverse events have been reported due to feeding tube[97, 98.]
- Dietary modification, change in food consistency, antacids etc may help In gastro esophageal reflux disease.
- Fundoplication for severe Gastro-oesophageal reflux may be done. No specific evidence is available with regard to CP children[99.]
- Supplementation of Vitamin D, Calcium and other micronutrients is needed to improve the child's nutritional status.

Drooling:

- One of the major co-morbidities of CP, drooling poses significant impedance to social acceptance.
- Various treatment modalities for drooling include
    - Oro-motor exercises
    - Pharmacotherapy includes drugs like Glycopyrrolate or trihexyphenidyl: act by reducing salivary flow and Botulinum toxin type A injection into salivary glands[100].
    - Surgery: unilateral ligation of submandibular and parotid ducts, removal of sublingual glands has all been tried but acceptance is low due to complications like ranula, dry mouth etc[101.]
    - Behavioral therapy: For older children who are able to understand commands, a trial of behavioral therapy is initiated.

Behavior therapy:

Children with chronic illness like cerebral palsy may develop unhealthy thoughts, suicide ideation and depression.

Cognitive behavior therapy has been helpful in identifying these thoughts and teaching cognitive restructuring and self management of constructive thinking and actions. Though no strong supportive evidence is found in CP children, due to its high quality evidence in non CP population may be beneficial in CP.

Conducive therapy: facilitates learning and rehabilitation[102].

Adaptive assistive approach: usage of supportive aids to improve daily functioning and communication[103].

Epilepsy management:

Being the most common co-morbidity of CP children, epilepsy management should be prioritized. Many times seizures are under recognized due to their partial/ focal nature[104.]

Appropriate oral anti epileptic drugs and a compliance are required for epilepsy management.

Pain Management:

Pain is almost always associated with vast majority of CP patients. Pain affects motor abilities and reduces sleep time there by affecting the quality of life of CP children. It's always important to communicate with the children who have good cognition or the parents regarding pain as it can be mitigated[105-107].

The various causes of pain and their management in CP is as follows: [37]

TABLE NO 4:

Causes	Symptoms/signs	Management
Spasticity	Motor tone abnormality	• Protection from hazards during spasticity • Physiotherapy and orthoses. • diazepam for acute spasms • baclofen for persistent increased tone; • Botulinum neurotoxin type A • selective dorsal rhizotomy • orthopedic surgery
Gastro-Esophageal reflux	Poor feeding, lethargy, irritability, vomiting, poor weight gain, aspiration pneumonia	• upright posture • regular small meals • H2 blockers and PPIs
Hip subluxation	Pain during walking, sitting and activities involving hip movements	• Orthotic changes • NSAIDs • Anti depressants • Surgery
Scoliosis and back pain	Pain on sitting or changes in shape of back	• Orthotic changes • NSAIDs • Anti depressants • Surgery
Constipation	Solid and infrequent stools	• Good tone management • Regular water, fruits and high fiber diet • Laxatives • suppositories

Speech and language difficulties:

Many children with CP have development delay. So speech and language delay are common in them. They are one of the causes for impaired Quality of life[108, 109].

Bowel and Bladder Dysfunction:

Constipation is a problem due to primary tone abnormalities, poor feeding practices and immobility. Adequate tone management, excessive water and fiber diet are used to treat. Laxatives and suppositories may be given.

Bladder dysfunction leading to incontinence may be treated with bio feedback mechanisms, drugs, and occasionally surgery. [110,111].

Intellectual impairment:

30% of the patients with CP show intellectual impairment. A large well documented review has shown how intellectual impairment has a negative effect on a child's Quality of life and this becomes particularly difficult during the transition phase into adulthood. Proper incorporation of lifespan perspective in pediatric, transition and adult medicine is needed for those with intellectual disabilities for protecting their early life gains.[112]

Medications for spasticity:

Oral medications: Easy to administer and have better compliance**.** The availability of evidence for the effectiveness of these drugs is either inconclusive or of low quality. Used in patients with mild and widespread tone abnormality[80.]

TABLE NO 5:

Drug	Mechanism of action	Dose	side effect
Baclofen[113,114]	Binds to $GABA_B$ receptors and inhibits excitatory neurotransmitters	Starts at 2.5g/day and titrated up to 20-60mg/day	• Constipation • risk of seizures
Tizanidine[80,115]	Central α-2 receptor agonist acting at spinal and supraspinal level	• Initial dose< 10 y: 1 mg twice daily> 10 y: 2 mg OD • Maximum0.05 mg/kg/d> 12 y: 2 mg TDS	• Hypotension • Depression • GI problems
Diazepam[115]	Binds to $GABA_A$ receptor enhancing endogenous inhibitory activity	Initial doses titrated to effect: • 1–12 mo: 0.25 mg/kg twice daily • 1–5 y: 2.5 mg twice daily • 5–12 y: 5 mg twice daily • 12–18 y: 10 mg twice daily (maximum 40 mg/d)	• Drowsiness • Hyper salivation • Respiratory depression • Tolerance and dependence.

Other medications for spasticity:

Botulinum toxin type A: given as intramuscular injections to reduce spasticity at dose of 4U to 16U/kg **to** produces chemo denervation**.** Best results are seen when given in children younger than 4 years without fixed contractures and have high quality evidence with strong recommendations of use for lower limb spasticity. When used along with occupational therapy has shown to improve hand functions. Systemic weakness, ptosis, urinary incontinence etc are among the side effects[116,117].

Phenol and alcohol: Perineurally injection using the guidance of electrical nerve stimulation under sedation or anesthesia, Painful procedure and results are temporary[80].

Intrathecal baclofen: Administered via subcutaneously implanted pump and higher levels are attained in CSF compared to oral drugs. May cause coma, respiratory depression[118, 119].

Surgical therapy:

Orthopaedic surgery and orthoses:

Surgical correction or prevention of contractures like equines foot deformity. Research showed poor quality evidence with chance of recurrence after early surgery[120]. Plaster casts to the limbs improve passive range of movements for lower limbs[121]. AFOs significantly reduce ankle excursion and increase dorsiflexion angle at foot strike and improve sit to stand transition[122, 123,124,125].

Many drugs are available for treatment of spasticity and in some adverse effects outweighs the effectiveness in treatment.

Evidence on oral medications like centrally acting drugs like Baclofen a GABA agonist, as reducing the muscle tone, improving motor function is conflicting and this is shown in Cochrane handbook for systemic reviews[11].

And a study by Goyal. V. et al showed no difference in the effectiveness of baclofen in comparison with tolperisone in reducing spasticity[12].

A study by Alper I. et al showed a maximum adverse effect with significant p value in the group treated with baclofen when compared to group treated with tizanidine[13]. So even though baclofen is most widely used drug the effectiveness of it is inconclusive and has maximum adverse effects. Hence, there is scope for use and evaluation of new drugs with better efficacy and less adverse effect in spasticity treatment.

From last few decades a new muscle relaxant which is centrally acting Tolperisone is in use in various parts of Europe and Asia. It's a piperdine derivative and action is by inhibition of pathologic mono and polysynaptic reflex activity in formation reticularis and spinal cord there by stabilizes the nerve membrane[7]. There are no sedative or with-drawal effects due to absence of substantial affinity of drug to adrenergic, cholinergic, dopaminergic or serotonergic receptors in CNS. A study by Rao R[14] et al in patients showed that on comparison of Tolperisone with thiocolchiocoside, the former showed better efficacy in 89.9% patients in patients with spasticity due to injury of spinal cord.

The existing data show by Stamenova study on spasticity treatment in post stroke spasticity patients showed modest effect of tolperisone very limited studies are present to know the efficacy and safety of tolperisone in spasticity secondary to cerebral palsy[126].

A study by Agarwal S et al showed a 58.67% improvement in functional out come in baclofen group when compared to 94.6% improvement in tolperisone and adverse events were seen in 14 patients in baclofen group and 32 patients in tolperisone group. But this trail included both adult and children with spasticity secondary to stroke or cerebral palsy were included and this was the only study

conducted in India to study the new drug, Tolperisone[7]. No study is available including children with spastic cerebral palsy. There is need for trial including children to know the efficacy and tolerability of tolperisone so that a better treatment with reduced adverse effects can be aimed at and our study is one of its kind for evaluation of effectiveness of tolperisone.

METHODOLOGY

This study was conducted from March 2019 to June 2020 in the Child Development clinic of KLES Dr Prabhakar Kore Hospital and Medical Research centre (MRC), Belagavi, a 2400 bedded hospital including super-specialties.

Study Design:

Hospital Bases Randomized control study – open label

Study duration and study period:

One and half year duration from March 2019 to June 2020

Place:

Study was conducted in the child developmental clinic (department of Paediatrics), KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi, a teaching hospital affiliated to Jawaharlal Nehru Medical College, Belagavi.

Source of Data:

Children of more than 1 year age with spastic or mixed cerebral palsy attending CDC of KLE Dr Prabhakar Kore Hospital were included for the study at first visit.

INCLUSION CRITERIA:

Children above 1 year with clinical diagnosis of cerebral palsy (spastic /mixed-spastic CP), newly diagnosed or not on any medications for more than a month

EXCLUSION CRITERIA:

1. Spasticity caused by any other causes like cerebral stroke, spinal cord injury, traumatic brain injury, multiple sclerosis after 2 years of age.
2. If already on treatment with any other drugs for spasticity.
3. If has undergone any surgery for spasticity

Sample size :

A convenient sampling of 60 children with cerebral palsy attending Child development clinic between March 2019 to June 2020 fulfilling the criteria.

Ethical clearance:

Prior to the commencement, study was approved by the institutional ethical committee, Jawaharlal Nehru Medical College, Belagavi.

This trial was registered in CTRI with this number CTRI/2019/12/022585.

Informed Consent:

Parents of the children with cerebral palsy who fulfilled the eligibility criteria were briefed about the nature of the study. Also, prior to the enrolment a written informed consent was obtained in the language known to them.

METHODOLOGY:

Once the child was registered in the CDC outpatient clinic, he/she was examined after taking a thorough history and classified into the respective type of cerebral palsy.

If the child fulfilled the eligibility criteria he/she was enrolled into the study and were randomized in to 2 groups according to random number table. Children with any other cause of spasticity or already on medication were excluded from study.

After taking the consent, relevant data was obtained from the parents and recorded in a structured proforma along with the details of examination.

The demographic details, presenting complaints, antenatal, perinatal and postnatal history, infancy history, relevant family history, details of thorough CNS examination and other systemic examination, relevant investigation reports like MRI were obtained if required.

The child was classified into respective type of CP– anatomical and topographic classifications. He or she was also classified as per functional classification systems – Gross Motor Functional Classification system (GMFCS).

To know the severity of spasticity child was subjected to scoring systems of spasticity like Modified Ashworth scaling , QUEST(Quality of upper extremity Skills Test) and GMFM(Gross motor function measures) and this was done with the help of pediatric physiotherapist(Department of physiotherapy, JNMC).

The neurological assessment of each patient was confirmed by Paediatric neurologist.

The parents/care-takers were subjected to a questionnaire – the Lifestyle assessment Questionnaire-CP (LAQ-CP) (*vide infra*) and the score was calculated after ensuring that the parent/care-taker understood it in detail. Translators were used whenever necessary. The questionnaire was filled by the investigators based on the answers given by the care-givers.

After the final diagnosis and assessment of the severity of spasticity, he or she was subjected to interventional therapies according to the group they were included:

- Baclofen – would be started at 0.5mg/kg in three divided dose and then increased to 1mg/kg/day

OR

- Tolperisone dose- <6years -2.5mg/kg/day in three doses, would be increased to 5mg/kg/day, 6-14 years – 2mg /kg/day in three doses, increased to 4mg/kg/day.[7]

For the cases of mixed CP who were included in the study other than the interventional drug, they were also treated with Gabapentin and Trihexyphenydyl for dystonia. All 60 subjects were also referred for physiotherapy.

Follow up period: Patients were followed up at 3rd month. A telephonic interview was done at 1 month to know the compliance with medication and regarding any adverse events related to medication. Clinical evaluation for clinical improvement in spasticity was done at the end of 3 months using Modified Ashworth scale (MAS), Gross motor function measures (GMFM66), Quality of upper extremity

skill test (QUEST) and LAQCP was assessed with help of set of questionnaire to the caregiver.

Outcome variables:

A. CLINICAL IMPROVEMENT IN SPASTICITY

1. MAS (MODIFIED ASHWORTH SCALING) –It is a tool to measure the increase in the muscle tone. Bohannon and Smith proposed the Modified Ashworth scale. Based on the resistance offered to high and low Velocity passive movements MAS grades were given from 0 to 4(0,1.1+,2,3,4) more the grading more is the severity of spasticity. It is graded in both upper limb and lower limb as Elbow, wrist, Hamstrings, Quadriceps, Gastronomies and soleus. The scale is as follows:"0: No increase in muscle tone, 1: Slight increase in muscle tone, with a catch and release or minimal resistance at the end of the range of motion when an affected part(s) is moved in flexion or extension, 1+: Slight increase in muscle tone, manifested as a catch, followed by minimal resistance through the remainder (less than half) of the range of motion, 2: A marked increase in muscle tone throughout most of the range of motion, but affected part(s) are still easily moved, 3: Considerable increase in muscle tone, passive movement difficult, 4: Affected part(s) rigid in flexion or extension"

2. QUEST (QUALITY OF UPPER EXTREMITYSKILL TEST) “Quality of Upper Extremity Skills Test (QUEST) is a reliable and valid assessment tool that evaluates functional quality of the upper limb in four areas: QUEST A - dissociated movement (shoulder, elbow, wrist, fingers - 32 items), QUEST B - grasp (cube of 2.5 cm, cereals, pencil or pen - 12 items), QUEST C - protective extension (anterior, lateral, posterior - 18 items) , QUEST D - weight bearing (in prone, quadruped - 25 items)., QUEST evaluates head, trunk and shoulders position during grasp movement, classifying them under normal or atypical”. Total and each domain score may range from zero (worst performance) to 100 (best performance).

3. GMFM(GROSS MOTOR FUNCTION MEASURES) The Gross Motor Function Measure (GMFM) is an assessment tool designed to measure changes in gross motor function in 5 domains of motor function – lying and rolling, sitting, crawling and kneeling, standing, walking, running and jumping. The actual version of the GMFM, the GMFM-88, consists of 88 items. The GMFM-66 is a 66 item subset of the GMFM 88 identified through Rasch analysis to best describe the gross motor function of children with cerebral palsy. Each item is scored on a 4 point ordinal scale 0-3, where” 0 indicates that the child does not initiate the task,1 indicates that the child initiates the task(completes <10% of activity) ,2 indicates that the child partially completes the task (10-99% of activity),3 indicates that the child completes the task(100%) and NT indicates that the child was not tested”. Three trails are allowed following which each dimension score are expressed as percentage of maximum score for that dimension. As suggested, in our study GMFM 66 is used for assessment.

4. LAQ-CP (LIFESTYLE ASSESSMENT QUESTIONNAIRE) LAQ-CP questionnaire is used to evaluate the impact of disabilities in children with CP and their families. It has simple questions, systematized into six dimensions: clinical burden, physical independence, mobility, schooling, economic burden and social integration. Among these, clinical burden, physical independence, and mobility are directly concerned with the child's neurological status. Based on scores in each dimension, dimensional scores were calculated and a final standard score was obtained. They are expressed as a percentage score.

The scores were analyzed as below

- ❖ Good- scores < 30%
- ❖ Mildly affected- scored between 30-50%
- ❖ Moderately affected – scores between 51-70%
- ❖ Severely affected- scores >70%

The impact of interventions was assessed based on pre and post intervention LAQ-CP scores, which is tested for significance on the basis of improvement of post intervention scores over pre intervention scores.

5. Adverse effects of Baclofen and Tolperisone.

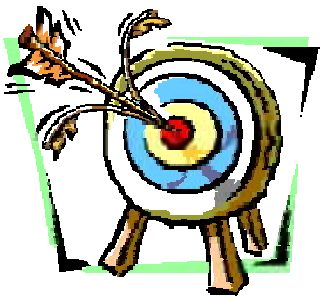
6. Cost analysis of the Baclofen and Tolperisone.

Data analysis:

The data which was obtained was coded and entered into Microsoft excel worksheets and analyzed using SPSS version 20.

Continuous variables were expressed as Mean ± Standard Deviation. The MAS, QUEST, GMFM and LAQ-CP scores were calculated before and after interventions and compared using mean and standard deviations and Wilcoxon signed-rank test. A non parametric test (Wilcoxon signed-rank test) was used as the study outcome values did not have normal distribution. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant. For the categorical data frequencies was calculated and expressed as percentages.

Introduction



Objectives

Review of Literature

Methodology

Results

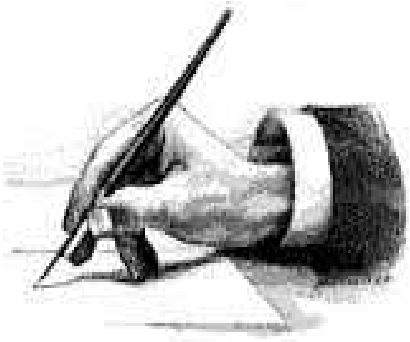
Discussion

Limitation

Conclusion

Summary

Bibliography



Annexure-I

Annexure-II

Annexure-III

Annexure-IV

Annexure-V

Annexure-VI

Annexure-VII

Annexure-VIII

RESULTS

RESULTS FOR CLINICAL EFFICACY OF BACLOFEN VS TOLPERISONE IN TREATING SPASTICITY IN CHILDREN WITH CEREBRAL PALSY

A Randomized controlled trail was conducted to study the efficacy and acceptability of the less known centrally acting antispastic drug Tolperisone in comparison to most commonly used Baclofen in children with spastic cerebral palsy. It was conducted over a period of 1 year from March 2019 toJune 2020 at Child developmental clinic, Department of pediatrics, DrPrabhakarKore Hospital.

A total of 65 samples were collected, out of which 5 were lost for follow up 3 in baclofen and 2 in tolperisone reason being 2 children due to pandemic situation, 1 child had fracture of lower limb so was excluded from the study and 2 patients were not compliant with the medication. So study was conducted with sample size of 60 who were divided in to 2 groups of Baclofen and Tolperisone according to random number table and were followed up by telephone call at the end of 1 month to know the child's condition and compliance with the medication and again at 3 month at CDC for clinical assessment.

Tables – 12

Figs - 12

DEMOGRAPHIC DATA

1. AGE DISTRIBUTION

Children in the age group between 1-15 years were enrolled in the study. The age distribution in baclofen and tolperisone group is depicted in table no 6

TABLE NO 6

AGE GROUP	BACLOFEN	TOLPERISONE
1-5YEARS	23(76.6%)	21(70%)
5-10 YEARS	5(16.6%)	8(26.66%)
>10 YEARS	2(6.66%)	1(3.33%)

In our study, the age distribution was from 1-15 years out of which, majority of the children i.e. n=45 (75%) were in the age group of 1-5 years and only 3 patients were above 10 years.

Mean age was 4.06 years in baclofen group and 3.86 years in tolperisonegroup

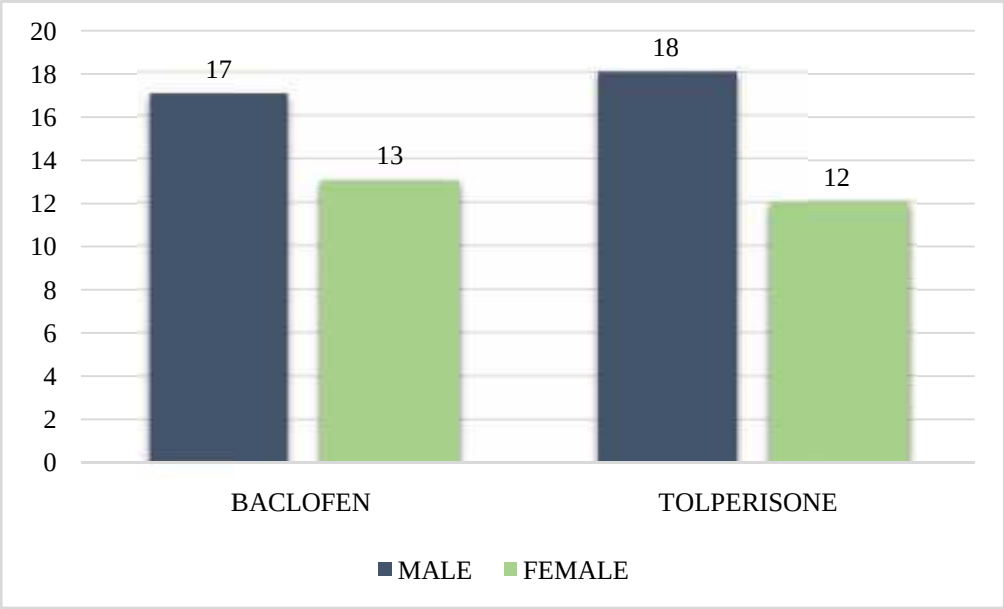
.

2. GENDER DISTRIBUTION

Out of 60 children who completed the study,35(60%) were male.

The gender distribution of subjects in Baclofen and Tolperisone group is shown in Fig no 1

FIG NO 1

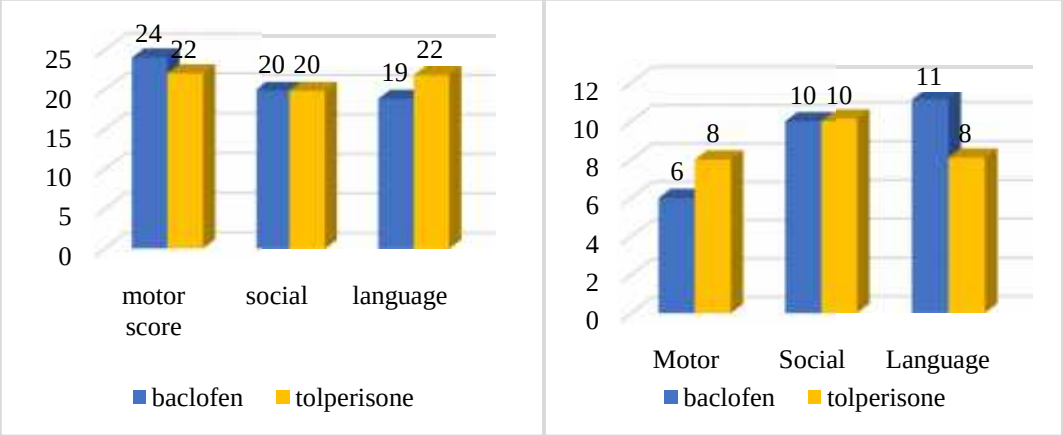


In our study, Male to female ratio was 1.4:1. While in Baclofen group it was 1.3:1 and in Tolperisone group it was 1.1:1.

3. **DEVELOPMENTALQUOTIENT(DQ)/INTELLECTUAL QUOTIENT (IQ).**The DQ wasassessed below 5 years of age based upon developmental history and developmental assessment while for children >5years IQ was assessed.

Distribution of subjects based upon motor, language and social milestones in Baclofen and Tolperisone group is depicted in Fig no 2

FIG NO 2



Developmental quotient below 70 Developmental quotients above 70

Our study showed in both the group more than2/3rd of the patients had DQ/IQ less than 70 in all components i.e. motor, social and language.

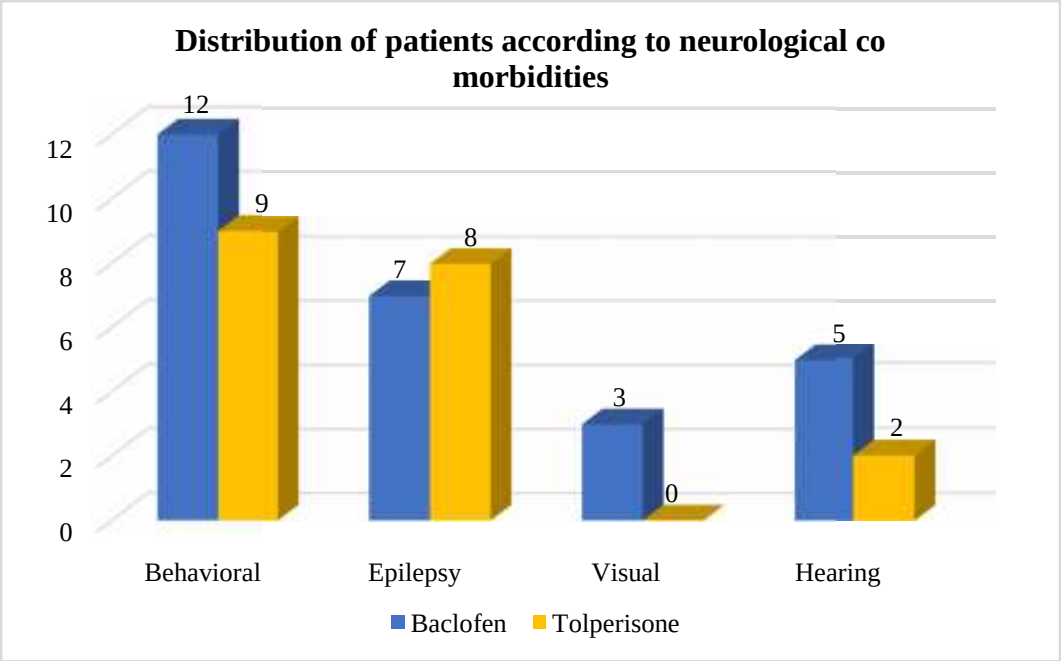
The distribution of children based upon the DQ/IQ score in both Baclofen and Tolperisone group is comparable.

4. NEUROLOGICAL CO-MORBIDITIES

The children in the study were screened for neurological co morbidities like behavioraldisturbances, seizures, hearing/visual impairments.

The distribution of neurological co morbidities in both the groups is shown in Fig no 3

FIG NO 3



In our study almost n=30(50%)of the patient had neurological co-morbidities.

The most common neurological morbidity was Behavioral problem in the form of apathy/hyperactivity seen in for n=12(40%) in Baclofen group and n=9(30%) in Tolperisone group. Following this in the both the group seizures was the second most common with 7(23.33%) patients in baclofen and 8(26.66%) in tolperisone group.

There were no patients with visual problem in tolperisone group while 3(10%) children in Baclofen had visual problem in the form of squint and refractory error.

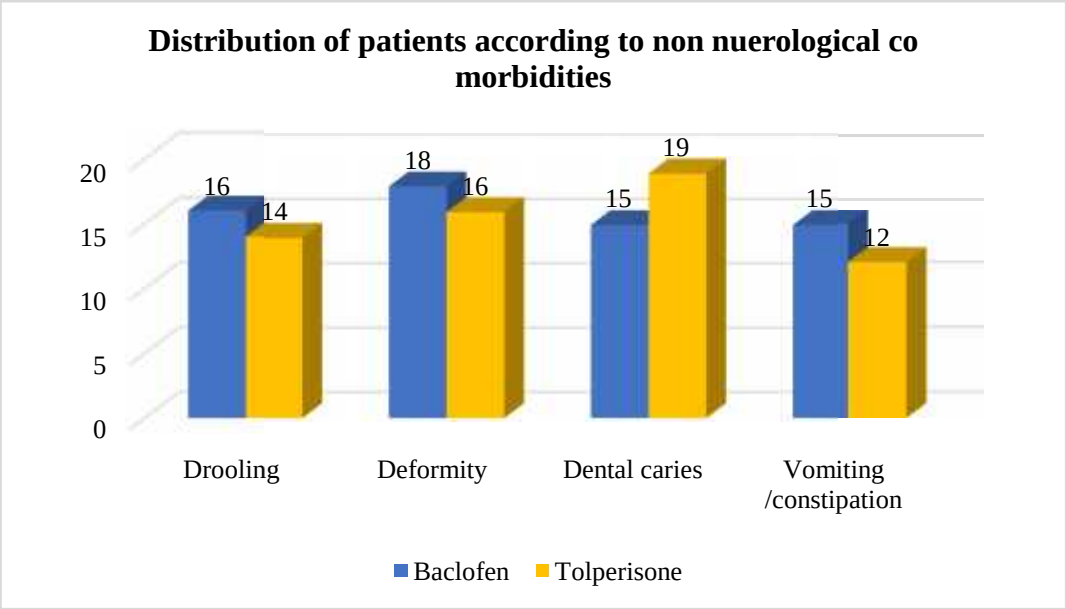
Hearing defects was present 5(16%) in Baclofen and 2(6.66%) in Tolperisone group based on audiometric test.

5. NON NEUROLOGICAL CO-MORBIDITIES

The children in the study were screened for non neurological co-morbidities like drooling, deformities, dental caries, GI disturbances.

Various non neurological co-morbidities in both the groups are shown in Fig no 4

FIG NO 4



In our study most common non neurological co morbidity was deformity and dental caries with 34(56.66%) in each followed by drooling and GI disturbances.

The distribution of co morbidities among 2 groups is similar and is comparable.

6. BIRTH HISTORY.

Birth records of all the children were carefully looked in for gestational period type of delivery, presence of PROM, cry at birth, birth weight and NICU admission. Distribution of subjects in both the groups based on various birth factors is shown in table no 7

TABLE NO 7

BIRTH FACTOR	BACLOFEN	TOLPERISONE	P VALUE
PRE TERM	8(26%)	11(36.66%)	0.812
LSCS	3(10%)	4(13%)	0.789
PROLONGED PROM	3(10%)	10(33.3%)	0.015
DELAYED CRY AT BIRTH	14(46%)	14(46.66%)	0.795
SGA	9(30%)	19(63.3%)	0.001
NICU ADMISSION	26(86.6%)	28(93.3%)	

In the current study, a total of 19(31.66%) children were born preterm and 41(68.33%) were born at term. There were no post-dated babies. 7(11.6%) out of 60 had LSCS as mode of delivery. PROM(premature rupture of membrane) is defined as rupture of membranes before the onset of labor was seen in 13(21.66%) cases[3(10%) in baclofen and 10(33.3%) in tolperisone group and p valuewas 0.015]

Delayed cry(referred to as babies who required assistance in terms of bag and ventilation immediately after birth) was seen in 28(46.66%) children with 14(46%) patients in each group and were comparable. SGA children accounted for 28(46.66%) in total, out of which tolperisone group had 19(63.3%) and baclofen group had 9(30%).

NICU admission was seen in 56(93.33%) subjects, with 26(86.66%) patients in Baclofen group and 28(93.33%) in Tolperisone group.

TYPES OF CEREBRAL PASLY

7. TOPOGRAPHICAL CLASSIFICATION.

- Based on the limbs affected CP was classified into Diplegic (predominantly involving lower limb), Quadriplegic (involvement of all 4 limbs) and Hemiplegic(predominantly involving one side of the body).

Distribution of subjects based on topographical classification in both the groups is shown in table no 8

TABLE NO 8

Topographical classification	Baclofen	Tolperisone	Total
Diplegic	23(76.6%)	16(53.33%)	39(65%)
Quadriplegic	0	13(43.33%)	13(21.66%)
Hemiplegic	7(23.33%)	1(3.33%)	8(13.3%)

Pvalue – 1.004

This study showed, Diplegic CP as most common type with total of 39 (65%) patients followed by Quadriplegic CP with 13(21.6%) patients.

There were no cases of Quadriplegic CP in Baclofen group.

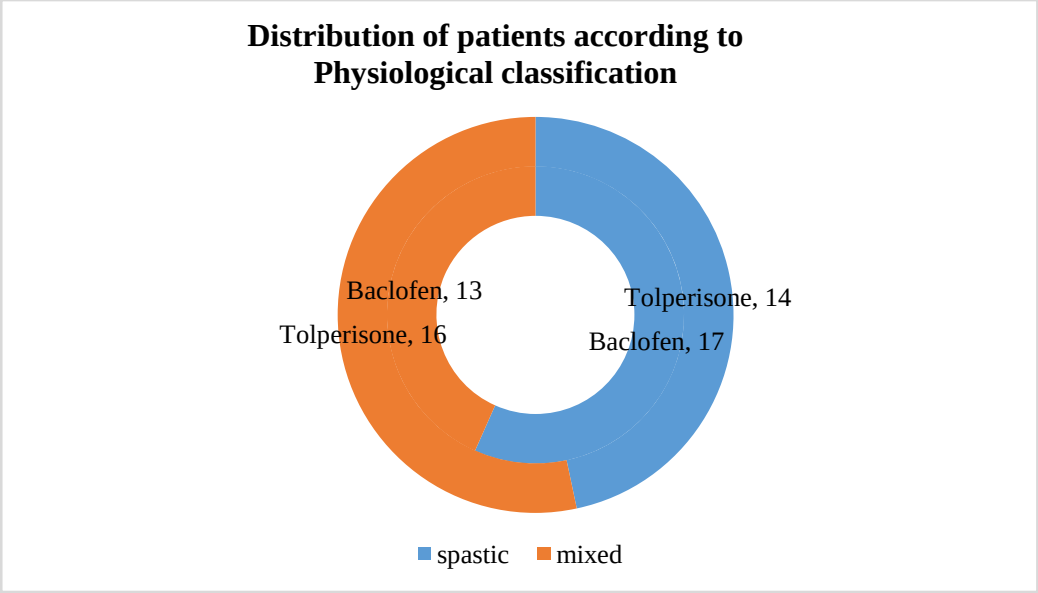
The distribution of different types of CP among the 2 groups as shown in above table is comparable with p value of 1.004 which is not statistically significant.

8. PHYSIOLOGICAL CLASSIFICATION

- HAT (HYPERTONIA ASSESSMENT TOOL) was used to assess the tone of the subjects and based upon the HAT score subjects were divided in to Spastic CP, mixed CP and dyskinetic CP. Only spastic CP and mixed CP children were included in the study.

Distribution of subjects based on the tone in both the group is shown in Fig no 5

FIG NO 5



Current study showed spastic CP in 31(51.66%) patients and mixed CP in 29(48.3%) patients.

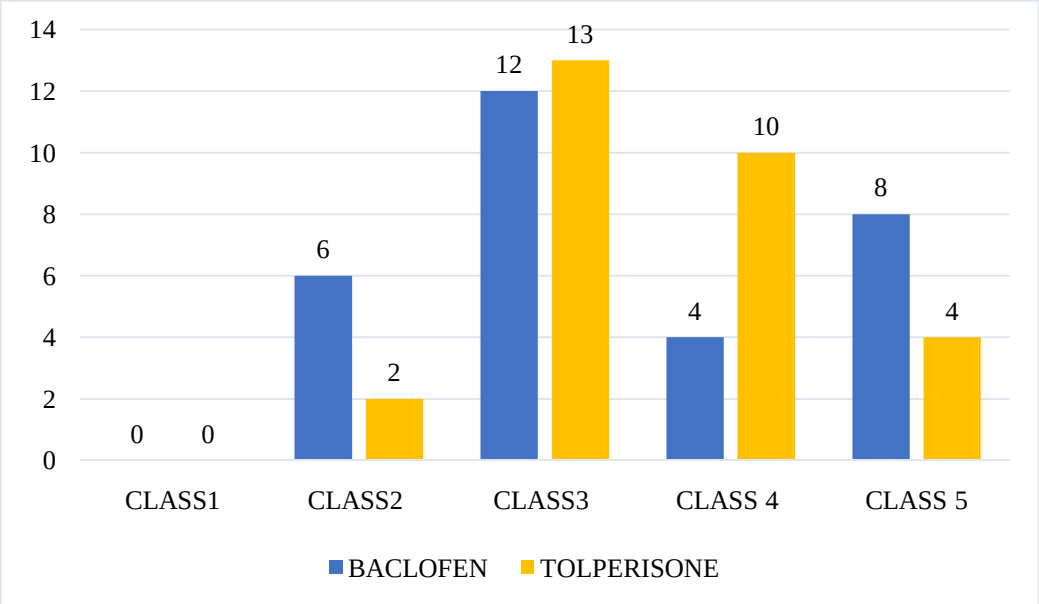
Distribution of different types of CP in both groups was comparable with p value of0.43(not statistically significant).

9. FUNCTIONAL CLASSIFICATION.

- GMFCS E &R(Gross motor functional classification scale, Expanded and Revised) is used for functional classification of children in to 5 levels.

Distribution of subjects based on GMFCS class in both the groups is depicted in Fig no 6.

FIG NO 6.



In this study, majority of children belonged to Class 3 with 25(41.66%) patients followed by 14(23.3%) in class 4 and 12(20%) in class 5.There were no children in Class 1.

The distribution of GMFCS in both the group was comparable with p value of 0.24.

PRE INTERVENTION ASSESSMENT OF SPASTICITY SEVERITY

10. MAS (MODIFIED ASHWORTH SCALING)Severity of spasticity of various muscles was assessed using MAS. Based on the resistance offered to high and low velocity movements MAS grades were given from 0 to 4(0,1.1+,2,3,4) and we assessed the spasticity in upper limb (elbow, wrist) and lower limb (hamstrings,quadriceps, Gastronomies and soleus) .

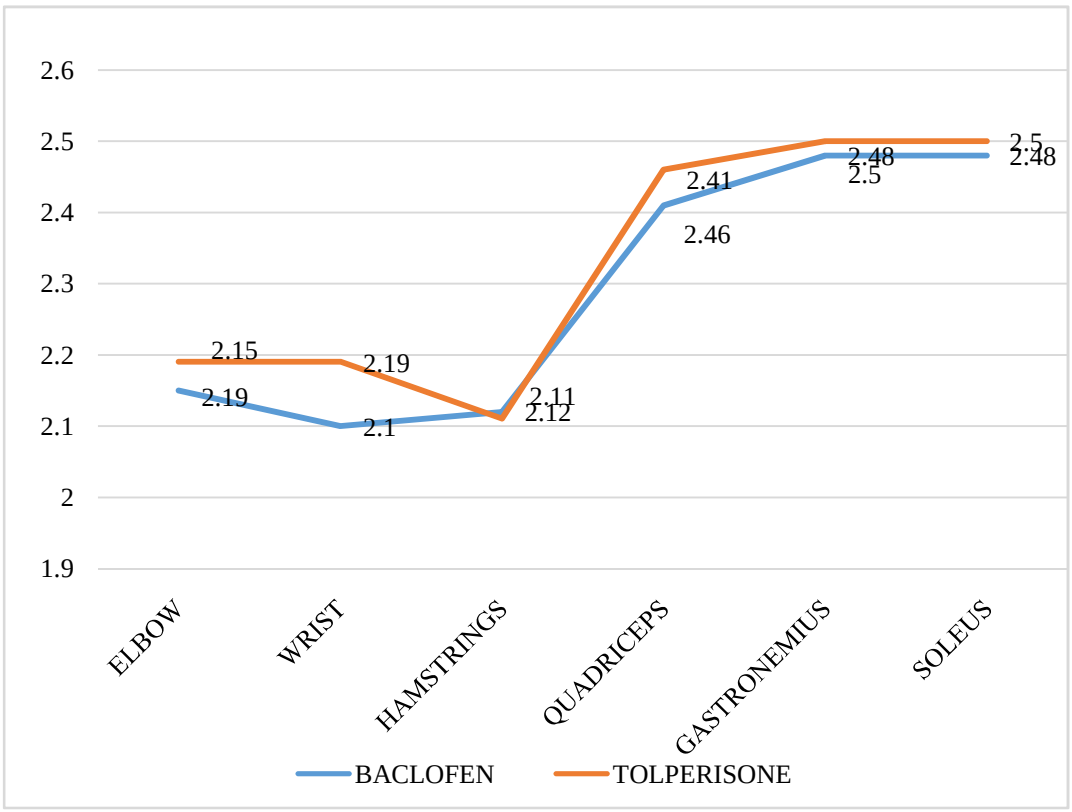
The mean values of MAS of various muscle group in both group is depicted in Table no 9 and Fig no 7

TABLE NO 9

MAS	**BACLOFEN**	**TOLPERISONE**	p value
	MEAN STD DEV	MEAN STD DEV	
ELBOW	2.15±0.5	2.19±0.40	0.439
WRIST	2.10±0.45	2.19±0.40	0.518
HAMSTRINGS	2.12±0.44	2.11±0.32	0.378
QUADRICEPS	2.41±0.50	2.46±0.5	0.617
GASTRONEMIUS	2.48±0.50	2.5±0.50	0.439
SOLEUS	2.48±0.50	2.5±0.50	0.593

WILCOXON SIGNED RANK TEST

FIG NO 7



As seen in the above table and fig MAS scores were comparable in both the group with p value of>0.05 in all the muscle group.

11. QUEST(QUALITY OF UPPER EXTREMITY SKILLS TEST)

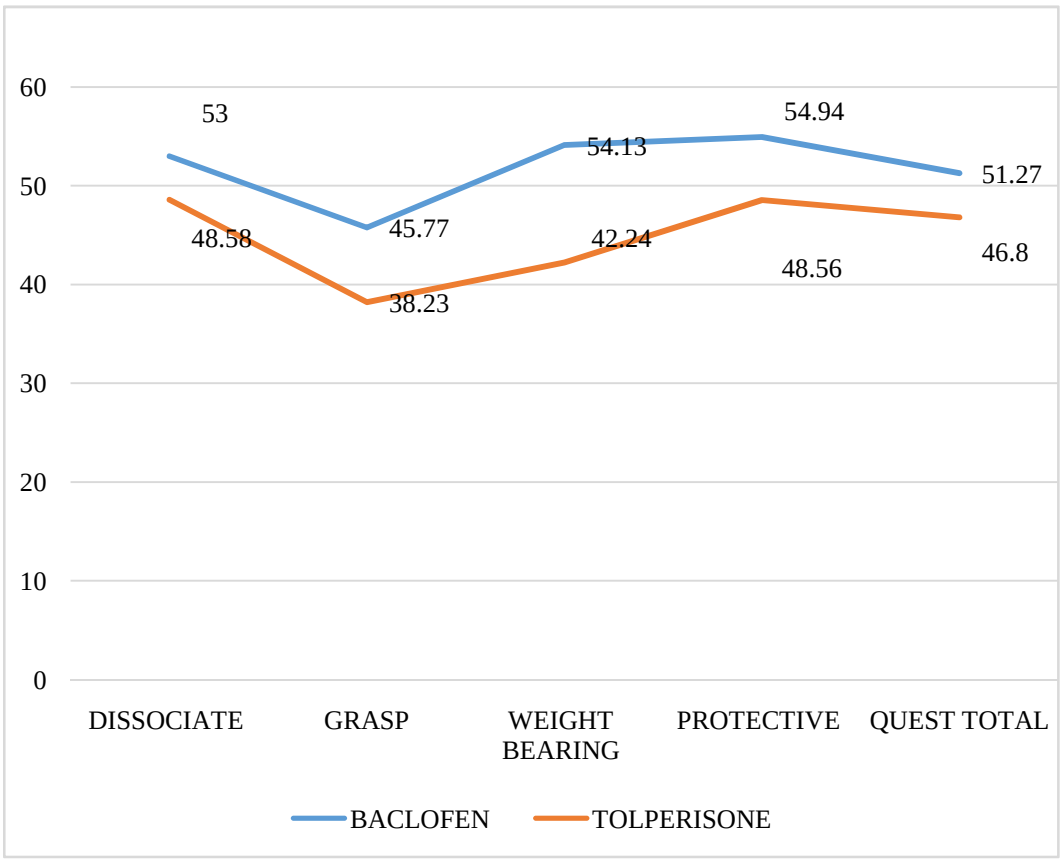
- Upper limb functioning was assessed by QUEST in 5 domains i.e. Dissociative, Grasp, Weight bearing and Protective domain.

QUEST scores of these 5 domains in both baclofen and tolperisonegroup is depicted in table no 10 and Fig no 8

TABLE NO 10

QUEST	BACLOFEN	TOLPERISONE	P value
	MEAN STD DEV	MEAN STD DEV	0.668
DISSOCIATE	53±20.27	48.58±11.51	
GRASP	45.77±20.20	38.23±15.15	
WEIGHT BEARING	54.13±22.53	42.24±12.12	
PROTECTIVE	54.94±25.28	48.56±14.56	
QUEST TOTAL	51.27±21.07	46.8±18.40	

FIG NO 8



As shown in above table and fig, the QUEST score among 2 groups were comparable with p value of 0.668

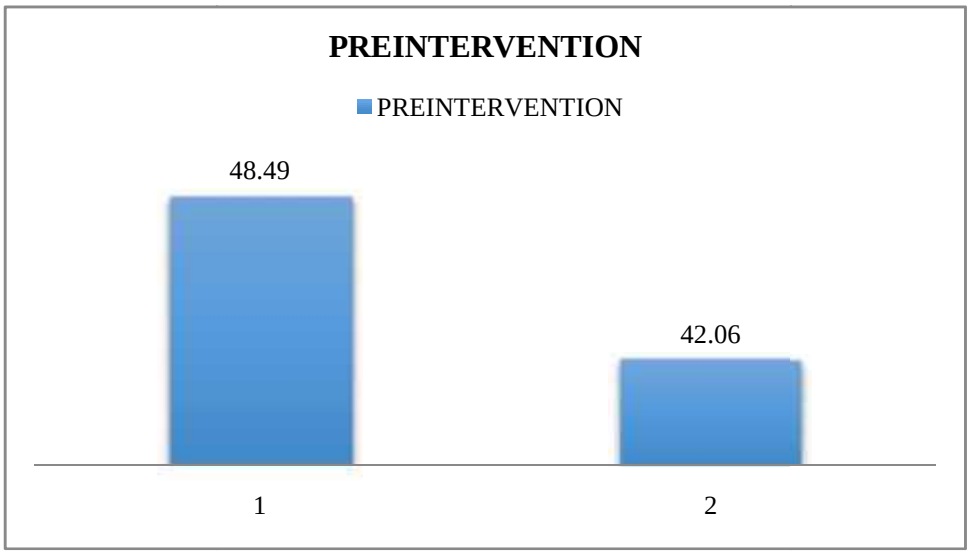
12. GMFM (GROSS MOTOR FUNCTION MEASURES)

GMFM is an assessment tool designed to measure the 5 domains of motor function – "lying and rolling, sitting, crawling and kneeling, standing, walking, running and jumping".GMFM 66 version is used where 66 items are used for the assessment.GMFM score distribution is both the groups before treatment is depicted in table no 11 and fig no 9

TABLE NO 11

	BACLOFEN	TOLPERISONE	P value
	MEAN STD DEV	MEAN STD DEV	
PREINTERVENTION	48.49±22.43	42.06±20.84	**0.042**

FIG NO 9



As shown in the above table and fig, the GMFM score in tolperisone group is on lower side when compared to baclofen with p value of 0.042 which is statistically significant.

13. LAQ CP

- Is assessed by interviewing the patients. It tells at given point of time the impact of disabilities on the lives of children with cerebral palsy and their family, as perceived by the child's parentsor career.
- Question are asked to assess the baby in components like Physical Independence, Mobility, Clinical burden, schooling, economic burden and social integration

Distribution of LAQCP scores in both the groups is depicted in Table no 12

TABLE NO 12

	BACLOFEN	TOLPERISONE	P value
	MEAN STD DEV	MEAN STD DEV	
PREINTERVENTION	66.81±15.31	59.66±12.31	0.593

The LAQCP values between the 2 groups were comparable with p value of 0.5.

EFFECT OF DRUG THERAPY ON SPASTICITY

14. DRUG INTERVENTION.

Out of 60 samples which were enrolled, they were randomized in to two group of 30 each using random number table.

- Baclofen was the interventional drug in group I given at a dose of 0.5mg/kg in three divided dose for initial 1 week and gradually increased to 1mg/kg/day based upon tolerance. Mean dose is 14.2mg.
- Tolperisone was started in group II at a dose of <6years –2.5mg/kg/day in three doses, would be increased to 5mg/kg/day after 1 week.6-14 years – 2mg /kg/day in three doses initially for 1 week followed by, increased to 4mg/kg/day.[7]Mean dose is 67.3mg.

Follow up done at the end of 1 and 3 months and were assessed for clinical improvement by MAS, QUEST, GMFM and CPQOL scores and also adverse effects were evaluated.

15. EFFECT OF INTERVENTION ON MAS SCORE.

TABLE NO 13Comparison of MAS scores, pre and post intervention.

TABLE NO 13:

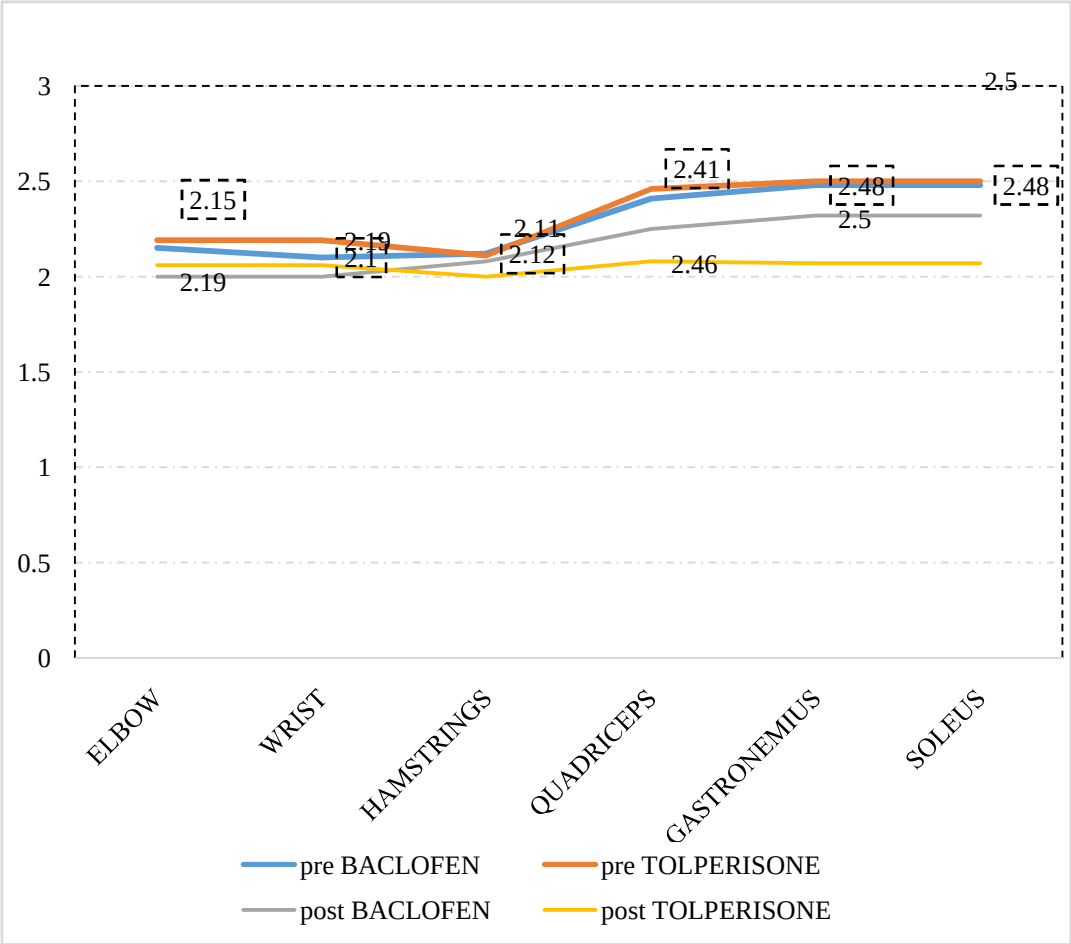
	Pre intervention		Post intervention		
MAS	Baclofen	Tolperisone	Baclofen	Tolperisone	P*value
	MEAN STD DEV	MEAN STD DEV	MEAN STD DEV	MEAN STD DEV	
Elbow	2.15±0.5	2.19±0.40	2.0±0.34	2.06±0.25	0.969
Wrist	2.10±0.45	2.19±0.40	2.0±0.43	2.06±0.25	0.959
Hamstrings	2.12±0.44	2.11±0.32	2.08±0.4	2±0	0.978
Quadriceps	2.41±0.50	2.46±0.5	2.25±0.44	2.08±0.27	0.971
Gastronimeus	2.48±0.50	2.5±0.50	2.32±0.47	2.07±0.27	0.994
Soleus	2.48±0.50	2.5±0.50	2.32±0.47	2.07±0.27	0.988

*Pvalue – Difference in the mean value between baclofen and tolperisone post intervention.

WILCOXON SIGNED RANK TEST

As seen in table no 8 after treatment with drugs either Baclofen or Tolperisone, there was reduction in the mean values of MAS score resulting in clinical improvement in spasticity in both the groups. The improvement scores in both the groups are comparable with p value as shown in the above table is >0.05.

FIG NO 10 Comparison of MAS scores, pre and post intervention



As seen in above line diagram, there is reduction in the scores of MAS in 2 groups post intervention and this clinical improvement between 2 groups is comparable with p value of >0.5.

16. EFFECT OF INTERVENTION ON QUEST

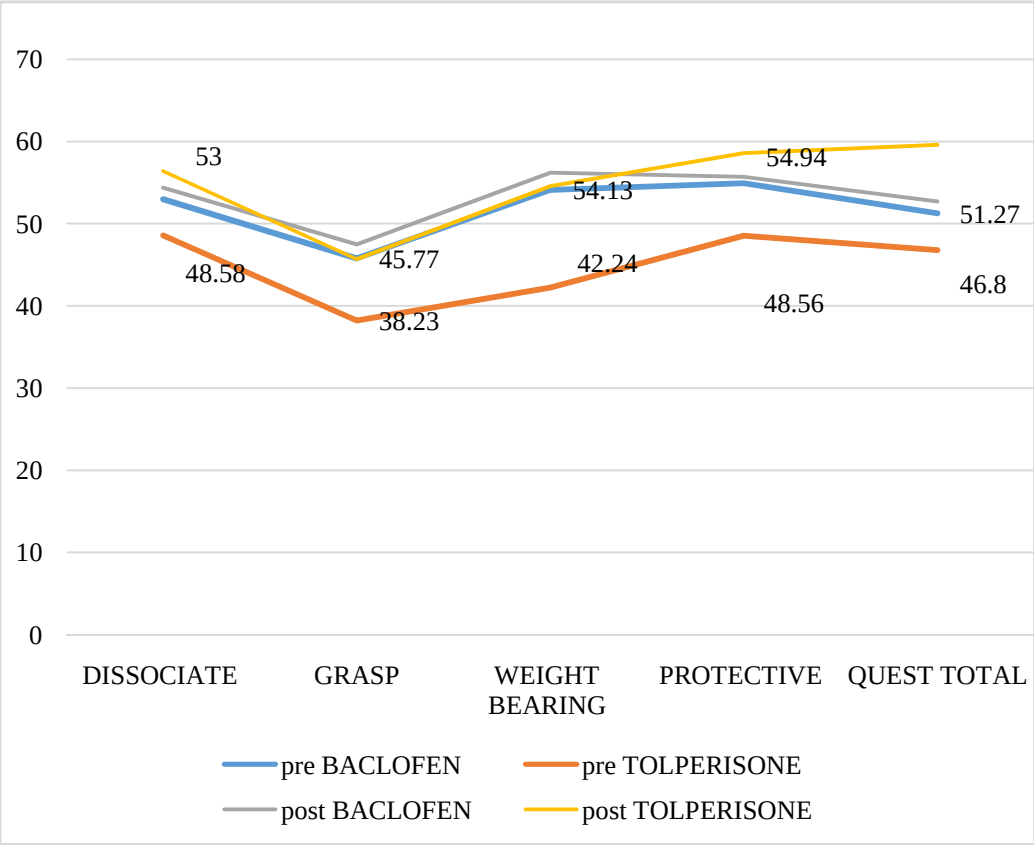
TABLE NO 14 Comparison of pre and post intervention QUEST values.

QUEST components	Pre interventional		Post interventional		
	Baclofen	Tolperisone	Baclofen	Tolperisone	P* value
	MEAN STD DEV	MEAN STD DEV	MEAN STD DEV	MEAN STD DEV	0.943
DISSOCIATE	53±20.27	48.58±11.51	54.4±21.39	56.64±10.50	
GRASP	45.77±20.20	38.23±15.15	47.48±21.21	45.71±11.41	
WEIGHT BEARING	54.13±22.53	42.24±12.12	56.22±22.76	54.59±30.6	
PROTECTIVE	54.94±25.28	48.56±14.56	55.72±24.79	58.59±15.40	
QUEST TOTAL	51.27±21.07	46.8±18.40	52.71±21.46	59.60±17.61	

*P value Difference in the mean values between Baclofen and Tolperisone group post intervention.

WILCOXON SIGNED RANK TEST

FIG NO 11 Comparison of pre and post intervention QUEST values.



As shown in the above table and fig the mean values of QUEST in all domains among both the groups shows improvement, indicating the clinical improvement. And the scores of improvement is comparable between the 2 groups with p value of 0.94 which is statistically insignificant.

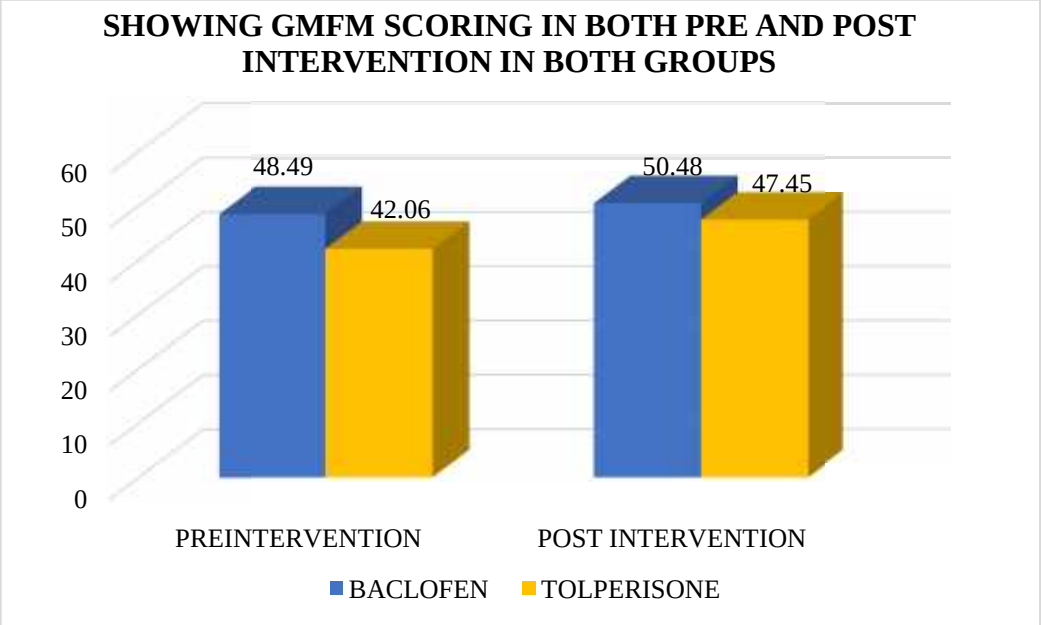
17. EFFECT OF INTERVENTION ON GMFM.

TABLE NO 15 showing pre and post intervention GMFM values in both the groups.

	BACLOFEN	TOLPERISONE	P value
	MEAN STD DEV	MEAN STD DEV	
PREINTERVENTION	48.49±22.43	42.06±20.84	**0.042**
POST INTERVENTION	50.48±22.13	47.45±20.07	**0.037**
MEAN DIFFERENCE	1.99	5.39	**1**

WILCOXON SIGNED RANK TEST

FIG NO 12 showing pre and post intervention GMFM values in both the groups



As shown in the above table no 17 and fig no 13, the pre intervention scores were less in tolperisone group as compared to baclofen group(p value<0.05) suggesting that children had more severe disability in tolperisone group. Post intervention there was improvement in GMFM scores in both the group with 5.39 point improvement in tolperisone and 2 point improvement in baclofen group, however this difference isnot statistically significant.

18. EFFECT OF INTERVENTION ON LAQCP

TABLE NO 16 showing LAQCP scoring in both pre and post intervention in both groups

	BACLOFEN	TOLPERISONE	P value
	MEAN STD DEV	MEAN STD DEV	
PREINTERVENTION	66.81±15.31	59.66±12.31	0.593
POST INTERVENTION	67.91±12.53	59.76±11.25	0.180

Our study showed not much improvement in the LAQCP scores as depicted in the above table.

19. ADVERSE EFFECTS

TABLE NO 17: Adverse effects of Baclofen and Tolperisone

	Baclofen,n(%)	Tolperisone,n(%)
Constipation	13(43.3%)	5(16.66%)
Drowsiness	9(30%)	4(13.3%)
Weakness	6(20%)	3(10%)
Dry mouth	2(6.66%)	1(3.33%)
Diarrhea	1(3.33%)	3(10%)
Anorexia	1(3.33%)	2(6.66%)
TOTAL	28*	18

*2 children in baclofen group who had constipation also had drowsiness as the adverse effect.

Our study, showed about 2/3rd (60%,n=36) of the children had adverse effects.

Almost 28(93.3%) had adverse effects in baclofen group in comparison to tolperisone where only 18 (60%) had adverse effects.Constipation was the most common adverse effect seen in 18(30%) of patients and was more in baclofen group(n=13,43.3%) in comparison to tolperisone group(n=5,16.66%).Following this drowsiness was the most common adverse effect in both group accounting for 9(30%) patients in baclofen group and 4(13.33%) in tolperisone group.Diarrhea and anorexia

was seen in 2(6.66%)patient in Baclofen group.Dry mouth was seen in 1(3.33%) patient in tolperisone group.

This shows Tolperisone is better tolerated when compared to Baclofen. Most of them were self limiting and none of the families discontinued treatment because of the side effects

AVERAGE COST OF THE DRUGS FOR 1 MONTH IN A 10KG CHILD

Baclofen is available in suspension (5mg/5ml) and tablet form at 10mg,20mg and 30mgFor a 10 kg child baclofen costs around Rs 537/- for suspension and Rs 360/- for tablets.

Tolperisone is available as 50mg,100mg and 150mg tablet.Tolperisone cost for 10 kg child in one month according to the die we used costs around Rs 204/-

Tolperisone stands out to be the less expensive when compared to Baclofen.

DISCUSSION

CP is one of the commonest childhood neurological disorders associated with varied spectrum of clinical presentation and co-morbidities which has detrimental effect on a child's quality of life.

The most common clinical symptom/presentation of cerebral palsy is spasticity. The quality of life such as hygiene, dressing, ambulation and sleep is affected due to spasticity. It leads to long term complications such as significant pain, contractures, joint subluxations and pressure ulcers. Therefore, treatment of spasticity is important to improve quality of life and minimize medical complication. There are a varied treatment options available for treatment of spasticity including non medical treatment such as physical therapy, occupational therapy[11.]

Medical treatment includes intra-thecal baclofen and oral medications, which are easy to administer and have better compliance**.** Oral Baclofen, a centrally acting muscle relaxant is most widely used in the treatment of spasticity amidst of its adverse effects. Tolperisone is a new, centrally acting muscle relaxant used since last few years and has shown itself as a very effective and safe. Problems like sedation and withdrawal phenomenons that are commonly seen with baclofen are not seen[7.]

Very limited studies are present to know the efficacy and safety of tolperisone in spasticity secondary to cerebral palsy in children[126].Our study aimed to study the efficacy and tolerability of tolperisone in treating spasticity in children with cerebral palsy and compare the effect with baclofen.

This study was conducted in KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi from March 2019 to June 2020. 65treatment naïve children with spastic and mixed cerebral palsy between the age group 1-15 years attending the child developmental clinic were enrolled for the study after meeting inclusion criteria.

They were randomized to two groups according to random number table and were subjected to physical examination like Modified Ashworth scaling, QUEST (Quality of Upper Extremity Score) and GMFM (Gross Motor Function Measures) for the assessment of degree of spasticity. Parents were subjected for set questionnaire for knowing the quality of life (LAQ-CP). According to the group randomized, the study subjects were started on either Baclofen or Tolperisone. They were followed up at the end of 3 months and same assessment scores were used to study the clinical improvement in the child.

In our study, we included children aged 1-16 years. Children below 1 years were excluded as the diagnosis of cerebral palsy is difficult to ascertain below one year of age and also the scales like QUEST, LAQ-CP which were used in our study is could not be applied in <1year child. In our study majority of the children i.e. n=45 (75%) were in the age group of 1-5 years and only 3 patients were above 10 years. This is similar to the study by Najar[127] et al which reported maximum cases between age group between 2-5 years with 78.94% and also to the study by Apexa G Vyas[128]et al who showed 87.5% were below 4 years of age group.

Mean age was 4.06 years in baclofen group and 3.86 years in tolperisone group.

Our study included more children <5 years as, most of older children were already on treatment and couldn't be included in our study.

In our study n=35(60%) were male and n=25(40%) were female with male to female ratio of 1.4:1. in Baclofen group it was 1.3:1 and in Tolperisone group it was 1.1:1.

These findings are consistent with the Dobhal[129] et al study from Delhi where 64% were males and 36% females. Ebru Yilmaz[130] et all study conducted in Turkey showed 58.8% were males and 41.2% were females, with a male to female ratio was 1.4:1. One possible reason for this could be gender bias that is prevalent in our society where in boys is provided better medical care than the girls.

Developmental delay/Intellectual disability was the most common comorbidity associated with cerebral palsy accounting to 50-60% of cases and in our study it is seen in 39(65%) [19(63.3%) in baclofen and 20 (66.6%) in tolperisone] had DQ/IQ value below 70.. A study by Hongbo Zhang[131] et al also showed that majority 77% of children were having DQ/IQ below 70% and only 22.9% had DQ/IQ more than 70% .The majority of children with severe and global delay shows the severity of the condition, need for early intervention and multimodality of treatment. And since ours is a referral centre more often severe cases which requires intervention were present in our study.

When we looked in to the associated co morbidities our study showed that other than developmental delay/intellectual disability, almost n=30 (50%) of the patient had other neurological co-morbidities. The most common neurological morbidity was Behavioral problem in the form of apathy/hyperactivity seen in for

n=12(40%) in Baclofen group and n=9(30%) in Tolperisone group. Following this, in both groups, seizures was the second most common seen [7(23.33%) patients in baclofen and 8(26.66%) in tolperisone group].There were no patients with visual problem in tolperisone group while 3(10%) children in Baclofen had visual problem in the form of squint and refractory error. Hearing defects was present 5(16%) in Baclofen and 2(6.66%) in Tolperisone group based on audiometric test. Comparison of occurrence of comorbidities in children with cerebral palsy with other studies showed,

Two Indian studies Amoghimath et al [32l] and Gowda et al [133] showed 40.5% and 46% of seizures, 4% and 11% cases of hearing defect and 19.5% and 26% of visual problems respectively. A study by Subramaniam ND[134] et al reported behavioral abnormality as most common co morbidity with 45% followed by seizures in 31%.The Surveillance for Cerebral Palsy in Europe (SCPE) collaboration has reported that 31% CP children had severe intellectual disability, 11% had severe visual disability, and 21% have epilepsy.

Among non neurological co morbidities, present study showed, that the most common non neurological co morbidity was deformities and dental caries in 34(56.66%) followed by drooling in 20(33.3%) and GI disturbances in 17(28.33%).

Dobhal[129] et al study had 42% recorded patients with drooling and 4 % with deformities.

Another study Hollung J[135]et all had 23% with dental caries and 39.1% with GI disturbances like vomiting or constipation.

High prevalence of deformities in our study was due to delayed referral of children with cerebral palsy and absence of physiotherapy centers in many semi-urban and rural places.

Our centre is in a district place and caters to mainly rural population. Dental caries is explained by neglected oral hygiene among the rural population.

Nineteen (31.6%) children were born out of consanguious marriage which matches with the figures reported by Subramaniam ND[134] et al study from southern India (23.33%). Bangashet al reported 50% consanguinity .They represent the prevalent cultural practices in different parts of the country

In our study, all 60(100%) were born at hospital indicating improvement in the availability of health care facilities and health care seeking behavior of people. A study by ApexaG.vyas[128] et al conducted in Gujarat, showed 93.7% deliveries were conducted at hospital in contrast to results by Subramaniam ND[134] et al study conducted in 2019 where 40% of the deliveries were at home and Bangash[136] et al showed 25% were delivered at home.

In this study, 19(31.66%) children were born premature and 41(68.33%) at term gestation.

There were no post-dated babies. Our data correlates with other studies from India as shown in table no 18.

TABLE NO - 18

Birth factors	Present study	Apexa G Vyas[128] et al	Dobhal[129]et al	Subramaniam[134] et al
Pre term gestation	19(31.6%)	25%	26%	11%
Term gestation	68.3%	75%	74%	89%
LSCS	7(11.6%)	18.75%	-	13%
Delayed cry at birth	28(46.6%)	68.75%	40%	23%
LBW	28(46.6%)	56.25%	-	20%

PROM (premature rupture of membrane) is defined as rupture of membranes before the onset of labor. Our study showed 13(21.66%) cases, 3(10%) in baclofen and 10(33.3%) in tolperisone group with PROM. A mynarek[137] M et al a national registry-based cohort study showed 11.6% of PROM. Subramaniam N D[134]et all an Indian study showed 16% cases of PROM. PROM can lead periventricular leukomalacia and present with spastic cerebral palsy.

In our study, NICU admission was seen in 56(93.33%) subjects, with 26(86.66%) patients in Baclofen group and 28(93.33%) in Tolperisone group. A study by Jain.V[138] on perinatal risk factors showed, out of total 217 (70.7%) children had a history of admission to Neonatal Intensive Care Unit (NICU) at the time of birth.

The present study showed that, Diplegic CP as most common type with total of 39 (65%) patients [23 (76.6%) in Baclofen group and 16(53.33%) in Tolperisone group].

This was followed by Quadriplegic CP. We had 13(21.6%) patients in Tolperisone group; there were no Quadriplegic CP in Baclofen group. Least being Hemiplegic CP was in total of 8 (13.3%) with 7(23.33%) in baclofen group and 1(3.33%) in tolperisone group.

In comparison with other studies, Subramaniam ND[134] et al had 72% of quadriplegic CP, 25% diplegic CP and 3 % of hemiplegic CP. Minocha P[139] et study of India also showed 56.6% cases of quadriplegic CP as most common followed by diplegic CP which is 16.11% and hemiplegic CP of 10%.Diplegic CP was more common in our study. A possible explanation for this could be that there were more number of premature babies and those associated with PROM in our study which commonly present as diplegic CP. The studies which showed Quadriplegic CP as common had birth asphyxia as a major etiological cause.

Our study showed physiological classification of spastic CP in 31(51.66%) patients and mixed CP in 29(48.3%) patients. Two Indian studies Subramaniam ND[134] et al and Minocha P[139] et al had 81% and 84.4% of spastic CP respectively, followed by 8% and 4.4% of mixed CP.

A Greece study by Drougia A[140] et all had 80.8% of spastic CP and 10.2% of mixed CP.

One reason for more prevalence of mixed CP in our study could be that we used an objective tool HAT to assess the tone, while other studies were based only on subjective assessment by the clinician.

GMFCS for cerebral palsy is based on self initiation of movement where sitting (truncal control) and walking are particularly emphasized. Class 1 signifies minimal brain dysfunction and class 5 signifies maximal brain dysfunction. Our study showed GMFCS class distribution as, majority of children belonged to Class 3 with 25(41.66%) patients followed by 14(23.3%) in class 4 and 12(20%) in class 5. Only 8 (13.33%) belonged to Class 2 and no children in Class 1.As shown in table no 19,our study in contrary had more children in class 3, 4 and 5, indicating more severe cases which is explained by the fact that since ours is referral centre we get more severe cases,.

TABLE NO 19 COMPARISON OF GMFCS GRADINGS WITH OTHER STUDIES

GMFCS CLASS	Present study	Zhang H[141] et al study	Ploypetch T[142] et al study	Rutz E[143] et al
CLASS 1	0	16.7%	24%	0
CLASS 2	13.33%	18.8%	12%	69%
CLASS 3	25%	27.1%	18%	33%
CLASS 4	23.3%	16.7%	22%	-
CLASS 5	20%	20.8%	24%	-

EFFECT OF DRUG INTERVENTION

MAS (MODIFIED ASHWORTH SCALING)

Severity of spasticity of various muscle was assessed using MAS. Based on the resistance offered to high and low velocity movements MAS grades were given from 0 to 4(0,1.1+,2,3,4) and we assessed the spasticity in upper limb (elbow, wrist) and lower limb (hamstrings, quadriceps, Gastronimeus and soleus) [47].

Our study showed, MAS values on comparison between pre-intervention and post intervention in Baclofen group as follows in upper limb, elbow (pre and post) – 2.15±0.5 and 2.0±0.34 then in wrist - 2.10±0.45 and 2.0±0.43. Lower limb evaluated in terms of muscle, Hamstrings- 2.12±0.44 and 2.08±0.4, Quadriceps- 2.41±0.50 and 2.25±0.44, Gastronemius-2.48±0.50 and 2.32±0.47, Soleus -2.48±0.50 and 2.32±0.47.

- MAS pre-intervention and post intervention values in Tolperisone group was in upper limb, elbow(pre and post) - 2.19±0.40 and 2.06±0.25, wrist-2.19±0.40 and 2.06±0.25. Lower limb showed, Hamstrings-2.11±0.32 and 2±0, Quadriceps-2.46±0.5 and 2.08±0.27, Gastronimeus- 2.5±0.50 and 2.07±0.27, Soleus-2.5±0.50 and 2.07±0.27.
- After treatment with drugs either Baclofen or Tolperisone, there was reduction in the mean values of MAS score implementing improvement in spasticity in both the groups. The improvement scores in both the groups are comparable with p value <0.05, which is statistically insignificant. This indicates that tolperisone is equally effective as baclofen as an anti spastic drug.

A study by Goyal[12] et al conducted in Mumbai where baclofen was used as intervention in treatment of spasticity showed that the improvement in MAS scores from 1.84±0.64(pre intervention) to 1.57±0.59 and 1.31±0.48(post intervention) at 1 and 3rd month follow up respectively.

A comparative study between Baclofen and Tolperisone conducted in Ahmedabad, India by Agarwal S[43] eta al showed a baseline MAS value of 3.34±0.05 and at 6 weeks post intervention as 1.55 ± 0.05 with p value of 0.048. The baseline value of MAS in Tolperisone group is 3.33±0.03 and 6 weeks post intervention is 1.57±0.05 with p value of 0.002. There was no notable difference in the improvement between 2 groups. This study like our study showed that there was a clinical improvement in both baclofen and tolperisone group .But this study subjects included adult patients with spasticity as a result of spinal cord injury.

QUEST (QUALITY OF UPPER EXTREMITY SCORE)

Quality of Upper Extremity Skills Test (QUEST) is a reliable and valid assessment tool that evaluates functional quality of the upper limb in four areas: "dissociated movement, grasp protective extension weight bearing". QUEST evaluates head, trunk, and shoulders position during grasp movement, classifying them under normal or atypical"[49, 50].

Scores were calculated for each subject by giving one point for every yes answer.one point for every "yes" answer. Thus, score may ranges from zero (worst performance) to 100 (best performance).

Our study showed a total QUEST score in baclofen (pre and post intervention) were 51.27±21.07 and 52.71±21.46 respectively. In tolperisone it is 46.8±18.40 (pre intervention) and 59.60±17.61 (post intervention). The mean values of total QUEST score among both the groups showed improvement, indicating the clinical improvement. And the scores of improvement is comparable between the 2 groups with p value of 0.94 which is statistically insignificant showing that even Tolperisone showed similar improvements as baclofen in the upper extremity Functioning.

GMFM (GROSS MOTOR FUNCTION MEASURES)

The Gross Motor Function Measure (GMFM) is an assessment tool designed to measure changes in gross motor function in 5 domains of motor function – "lying and rolling, sitting, crawling and kneeling, standing, walking, running and jumping". . "Each item is scored on a 4 point ordinal scale 0-3, where 0 indicates that the child does not initiate the task,1 indicates that the child initiates the task(completes <10% of activity) ,2 indicates that the child partially completes the task (10-99% of activity),3 indicates that the child completes the task(100%) and NT indicates that the child was not tested" Scores for each dimension are expressed as percentage of maximum score for that dimension and the total score is obtained by averaging the percentage score across the five dimensions[48].

Present study showed GMFM total scores in Baclofen, pre intervention values to be 48.49±22.43 and post intervention 50.48±22.13 with p value of 0.042. In tolperisone group it is 42.06±20.84 (pre intervention) and 47.45±20.07 (post intervention) with p value of 0.037. The pre intervention scores were less in tolperisone group as compared to baclofen group (p value<0.05) suggesting that

children had more severe disability in tolperisone group. Post intervention there was improvement in GMFM scores in both the group with 5.39 point improvement in tolperisone and 2 point improvement in baclofen group, however this difference is not statistically significant. The more severe GMFM scores in tolperisone group is explained by the presence of more Quadriplegic CP in this group.

A study by Lopez et al[144] where oral baclofen was used as intervention detected no improvement in the base line GMFM scores after 3 months of drug therapy.

Koval'chuk et al[146]., 2008, Muhammad et al[146]., 2017 have shown that, the Rivermead and the Barthel scales was good in tolperisone group, in comparison to tolperisone group.

LAQ-CP (LIFE STYLE ASSESSMENT QUETIONAIRRE FOR CEREBRAL PALSY)

The Questionnaire has been categorized into six domains and takes into account very minute details of the child's condition- clinical burden, economic burden, physical independency, mobility, schooling and social integration. The score measures at any given point, the impact of disabilities on the lives of children with CP, as perceived by the parents/ care-givers.

The present study showed LAQ-CP values in baclofen group was 66.81±15.31 (pre intervention) and 67.91±12.53(post intervention) with p value of 0.59 and in tolperisone group it is 59.66±12.3(pre intervention) and 59.76±11.25(post intervention) with p value of 0.18. Present study did not show much improvement in the LAQ-CP values. The study duration of just 3 months could be one reason that no notable changes in LAQCP scores were noted. A longer duration of study may reflect changes in the quality of life.

ADVERSE EFFECTS

Our study, showed about 2/3rd (60%, n=36) of the children had adverse effects Almost 28(93.3%) had adverse effects in baclofen group in comparison to tolperisone where only 18 (60%) had adverse effects. Constipation was the most common side effect seen in 18(30%) of patients and was more in baclofen group (n=13,43.3%) in comparison to tolperisone group(n=5,16.66%) .Following this drowsiness was common in both group accounting for 9(30%) patients in baclofen group and 4(13.33%) in tolperisone group. Diarrhea and anorexia was seen in 2(6.66%)patient in Baclofen group. Dry mouth was seen in 1(3.33%) patient in tolperisone group. This shows Tolperisone is better tolerated when compared to Baclofen.

A study by McKinlay et al[146] showed the side effects of baclofen as follows drowsiness (5), sickness (2), dizziness (2), slurred speech (2) and weakness (1). Whereas schienberg et all study showed constipation (2), seizures (2), drowsiness (1), Lethargy (1), poor appetite (1).

The side effect of baclofen was comparable with our study, except for diarrhea. Diarrhea was present in 1 patient in baclofen group and is not as a result of adverse effect but was due to viral infection which subsided within 2 days of supportive management.

Stamenova et al[126] study showed that only 14 patients out of 75 had adverse effects in tolperisone group when compared to the baclofen group which showed 36 out of 75 patients with adverse effects.

Over all this shows that the Tolperisone is better tolerated drug when compared to baclofen.

When we looked in to the cost analysis, it was seen that baclofen costed around Rs 537/- (suspension) and Rs 360/- (tablets) for total 1 month in a child with 10 kg, whereas it was Rs 204/- for tolperisone.

In our country where, many patients belong to rural area and low financial status the cost of therapy is important to consider.

Tolperisone appears to be almost half of the cost of baclofen, that would be the major advantage of tolperisone.

LIMITATION

- Our study had non normal distribution of data. So a larger sample size with normal distribution would have allowed us to use robust parametric test for the statistical analysis.
- All care givers of the study subjects were trained for home physiotherapy. The home therapy by care givers was not supervised.
- Since our study included even the mixed CP cases, they were on the other treatment for dystonic component. The other drug used might have affected our assessment of spasticity.

CONCLUSION

- In children with spastic CP (either predominantly spastic or in mixed spastic CP) the drug intervention in the form of Baclofen or Tolperisone showed clinical improvement in spasticity as evidenced by MAS, QUEST and GMFM scores.
- The efficacy of Tolperisone in treating spasticity was comparable with the efficacy of Baclofen.
- Tolperisone was shown to be better tolerated when compared to the baclofen as side effects in tolperisone were only 2/3rd of Baclofen.
- Tolperisone was much cheaper and well tolerated alternative to baclofen.
- Though both the drugs showed improvement in spasticity, it was not reflected in the quality of life of these children.

SUMMARY

This study was conducted in KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi from March 2019 to February 2020. 60 children with cerebral palsy between the age group 1-15 years attending the child developmental clinic were enrolled for the study after meeting inclusion criteria. They were randomized to two groups according to random number table and were subjected to physical examination like Modified Ashworth scaling, QUEST (Quality of Upper Extremity Score) and GMFM (Gross Motor Function Measures) for the assessment of degree of spasticity. Parents were subjected for set questionnaire for knowing the quality of life (LAQ-CP). According to the group randomized the study subjects were started on either Baclofen or Tolperisone drug.

They were followed up at the end of 3 months and same assessment scores were used to study the clinical improvement in the child. The study results are summarized below:

- The age distribution was from 1-15 years out of which, majority of the children i.e. n=45 (75%) were in the age group of 1-5 years and only 3 patients were above 10 years.

  Mean age was 4.06 years in baclofen group and 3.86 years in tolperisone group.
- Male to female ratio was 1.4:1. While in Baclofen group it was 1.3:1 and in tolperisone group it was 1.1:1.
- DQ/IQ evaluation showed that both the group more than 2/3rd of the patients had DQ/IQ less than 70 in all components i.e. motor, social and language. The

distribution of children based upon the DQ/IQ score in both Baclofen and Tolperisone group is comparable.

- 30 (50%) of the patient had neurological co-morbidities.

  The most common neurological morbidity was Behavioral problem in the form of apathy/hyperactivity seen in for n=12(40%) in Baclofen group and n=9(30%) in Tolperisone group. Following this in the both the group seizures was the second most common with 7(23.33%) patients in baclofen and 8(26.66%) in tolperisone group.

  There were no patients with visual problem in tolperisone group while 3(10%) children in Baclofen had visual problem in the form of squint and refractory error.

  Hearing defects was present 5(16%) in Baclofen and 2(6.66%) in Tolperisone group based on audiometric test.

- In our study most common non neurological co morbidity was deformity and dental caries with 34(56.66%) in each followed by drooling and GI disturbances.

  The distribution of co morbidities among 2 groups is similar and is comparable.

- This study showed, a total of 19(31.66%) children had preterm gestation and 41(68.33%) had term gestation. There were no post-datism babies. 7(11.6%) out of 60 had LSCS as mode of delivery. PROM(premature rupture of membrane) is defined as rupture of membranes more than one hour before the onset of labour was seen in 13(21.66%) cases, 3(10%) in baclofen and 10(33.3%) in tolperisone group and p value was 0.015(statistically significant) as PROM cases was more in tolperisone as compared to baclofen.

- Delayed cry (referred to as babies who required assistance in terms of bag and ventilation immediately after birth) was seen in 28(46.66%) children with 14(46%) patients in each group and were comparable. SGA children accounted for 28(46.66%) in total, out of which tolperisone group had 19(63.3%) and baclofen group had 9(30%).NICU admission was seen in 56(93.33%) subjects, with 26(86.66%) patients in Baclofen group and 28(93.33%) in Tolperisone group.
- Among topographical classification, Diplegic CP as most common type with total of 39 (65%) patients followed by Quadriplegic CP with 13(21.6%) patients. There were no cases of Quadriplegic CP in Baclofen group. The distribution of different types of CP among the 2 groups as shown in above table is comparable with p value of 1.004 which is not statistically significant.
- Current study showed spastic CP in 31(51.66%) patients and mixed CP in 29 (48.3%) patients. Distribution of different types of CP in both groups was comparable with p value of 0.43(not statistically significant).
- Functional classification (GMFCS) showed majority of children belonged to Class 3 with 25(41.66%) patients followed by 14(23.3%) in class 4 and 12(20%) in class 5.There were no children in Class 1 .The distribution of GMFCS in both the group was comparable with p value of 0.24.
- 60 enrolled study subjects were randomised in to two groups with 30 patients in each group. Group 1 received Baclofen and Group 2 received Tolperisone drugs according to the body weight.
- Patients in each group were followed up after 3 months to know the clinical improvement based on MAS, QUEST, GMFM, and LAQ-CP.

- -On comparison of MAS values pre-intervention and post intervention in Baclofen group showed in upper limb, elbow (pre and post) – 2.15±0.5 and 2.0±0.34 then in wrist - 2.10±0.45 and 2.0±0.43. Lower limb evaluated in terms of muscle, Hamstrings- 2.12±0.44 and 2.08±0.4, Quadriceps- 2.41±0.50 and 2.25±0.44, Gastronemius-2.48±0.50 and 2.32±0.47, Soleus -2.48±0.50 and 2.32±0.47.
  - MAS pre-intervention and post intervention values in Tolperisone group was in upper limb, elbow (pre and post) - 2.19±0.40 and 2.06±0.25, wrist- 2.19±0.40 and 2.06±0.25. Lower limb showed, Hamstrings-2.11±0.32 and 2±0, Quadriceps-2.46±0.5 and 2.08±0.27, Gastronimeus- 2.5±0.50 and 2.07±0.27, Soleus-2.5±0.50 and 2.07±0.27.
  - After treatment with drugs either Baclofen or Tolperisone, there was reduction in the mean values of MAS score implementing clinical improvement in spasticity in both the groups. The improvement scores in two groups are comparable with p value as shown in the above table is >0.05.
- The total QUEST score in baclofen (pre and post intervention) were 51.27±21.07 and 52.71±21.46. In tolperisone it is 46.8±18.40 and 59.60±17.61. The mean values of total QUEST score among both the groups show improvement, indicating the clinical improvement. And the scores of improvement are comparable among 2 groups with p value of 0.94 which is statistically insignificant.

- In total GMFM scores, the pre intervention scores were less in tolperisone group as compared to baclofen group(p value<0.05) suggesting that children had more severe disability in tolperisone group. Post intervention there was

improvement in GMFM scores in both the group with 5.39 point improvement in tolperisone and 2 point improvement in baclofen group, however this difference is not statistically significant.

- LAQ-CP values in baclofen group was 66.81±15.31(pre intervention) and 67.91±12.53(post intervention) with p value of 0.59 and in tolperisone group it is 59.66±12.3(pre intervention) and 59.76±11.25(post intervention) with p value of 0.18 .Present study did not show much improvement in the CPQOL values.
- Our study, showed about 2/3rd (60%, n=36) of children had side effects. Almost 28(93.3%) had adverse effects in baclofen group in comparison to tolperisone where only 18 (60%) had adverse effects. Constipation was the most common side effect seen in 18(30%) of patients and was more in baclofen group(n=13,43.3%) in comparison to tolperisone group(n=5,16.66%) .Following this drowsiness was the most common in both group accounting for 9(30%) patients in baclofen group and 4(13.33%) in tolperisone group. Diarrhea and anorexia was the least seen adverse effect with 2(6.66%) patient in Baclofen group. Dry mouth was the least adverse effect with 1(3.33%) patient in tolperisone group. This shows tolperisone is better tolerated when compared to Baclofen.
- Average cost of the drug, For a 10 kg child baclofen costs around Rs 537/- for suspension and Rs 360/- for tablets. Tolperisone cost for 10 kg child in one month according to the die we used costs around Rs 204/-Tolperisone stands out to be the less expensive when compared to Baclofen.

BIBLIOGRAPHY

1. Richards CL, Malouin F. Cerebral palsy: definition, assessment and rehabilitation. InHandbook of clinical neurology 2013 Jan 1 (Vol. 111, pp. 183-195).
2. Singh A, Singh M. Comparison of Modified Ashworth Scale and Modified Tardieu Scale on Assessment of Lower Limb Spasticity in Hemiplegic and Diplegic Cerebral Palsy. Indian Journal of Public Health Research & Development. 2019 1;10.
3. Paneth N, Hong T, Korzeniewski S. The descriptive epidemiology of cerebral palsy. Clinics in perinatology. 2006 ;33(2):251-67.
4. Ashwal S, Russman BS, Blasco PA, Miller G, Sandler A, Shevell M, Stevenson R. Practice parameter: diagnostic assessment of the child with cerebral palsy: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. Neurology. 2004 Mar 23;62(6):851-63.
5. O'Shea TM. Diagnosis, treatment, and prevention of cerebral palsy in near-term/term infants. Clinical obstetrics and gynecology. 2008 ;51(4):816.
6. Türkoğlu G, Türkoğlu S, Celik C, et al. Intelligence, functioning, and related factors in children with cerebral palsy. Archives of Neuropsychiatry. 2017 ;54(1):33.
7. Agarwal S, Patel T, Shah N, et al. Comparative study of therapeutic response to baclofen vs tolperisone in spasticity. Biomedicine & Pharmacotherapy. 2017;87:628-35.

8. Beckung E, Carlsson G, Carlsdotter S, et al. The natural history of gross motor development in children with cerebral palsy aged 1 to 15 years. Developmental Medicine & Child Neurology. 2007 ;49:751-6.
9. Taricco M, Adone R, Pagliacci C, et al. Pharmacological interventions for spasticity following spinal cord injury. Cochrane database of systematic reviews. 2000.
10. Gorgey AS, Chiodo AE, Gater DR. Oral baclofen administration in persons with chronic spinal cord injury does not prevent the protective effects of spasticity on body composition and glucose homeostasis. Spinal Cord. 2010;48(2):160-5.
11. Chang E, Ghosh N, Yanni D, Lee S et al. A Review of Spasticity Treatments: Pharmacological and Interventional Approaches. Crit Rev Phys Rehabil Med. 2013;25:11–22.
12. Goyal V, Laisram N, Wadhwa RK, Kothari SY. Prospective randomized study of oral diazepam and baclofen on spasticity in cerebral palsy. Journal of clinical and diagnostic research: JCDR. 2016 ;10:01.
13. Dai AI, Aksoy SN, Demiryürek AT. Comparison of efficacy and side effects of oral baclofen versus tizanidine therapy with adjuvant botulinum toxin type A in children with cerebral palsy and spastic equinus foot deformity. Journal of child neurology. 2016;31:184-9.
14. Rao R, Panghate A, Chandanwale A, et al. Clinical comparative study: efficacy and tolerability of tolperisone and thiocolchicoside in acute low back pain and spinal muscle spasticity. Asian spine journal. 2012;6:115.
15. Panteliadis CP, Hagel C, Karch D et al. Cerebral palsy: a lifelong challenge asks for early intervention. The open neurology journal. 2015;9:45.

16. Vyas AG, Kori VK, Rajagopala S, et al. Etiopathological study on cerebral palsy and its management by Shashtika Shali Pinda Sweda and SamvardhanaGhrita. Ayu. 2013; 34:56.
17. Bhinde SM. A case study on the Ayurvedic management of cerebral palsy. Ancient science of life. 2015; 34:167.
18. Accardo P. William John Little and cerebral palsy in the nineteenth century. Journal of the history of medicine and allied sciences. 1989;44:56-71.
19. Bodine C, Harkness L, Melonis M. Four. Assistive Technology and Science. 2012 Nov 16:107.
20. Keith RC, Mackenzie IC, Polani PE. The Little Club: Memorandum on Terminology and Classification of “Cerebral Palsy”. Developmental Medicine & Child Neurology. 1959;1:27-35.
21. Bax MC. Terminology and classification of cerebral palsy. Developmental Medicine & Child Neurology. 1964;6:295-7.
22. Mutch L, Alberman E, Hagberg B, et al. Cerebral palsy epidemiology: where are we now and where are we going?. Developmental Medicine & Child Neurology. 1992;34:547-51
23. World Health Organization. Disability prevention and rehabilitation: report of the WHO Expert Committee on Disability Prevention and Rehabilitation [meeting held in Geneva from 17 to 23 February 1981].
24. Bhati P, Sharma S, Jain R, et al. Cerebral Palsy in North Indian Children: Clinico-etiological Profile and Comorbidities. Journal of Pediatric Neurosciences. 2019;14(1):30.
25. Johnson A. Prevalence and characteristics of children with cerebral palsy in Europe. Developmental medicine and child neurology. 2002;44:633-40.

26. Oskoui M, Coutinho F, Dykeman J, et al. An update on the prevalence of cerebral palsy: a systematic review and meta- analysis. Developmental Medicine & Child Neurology. 2013;55:509-19.
27. Gladstone M. A review of the incidence and prevalence, types and aetiology of childhood cerebral palsy in resource-poor settings. Annals of tropical paediatrics. 2010;30:181-96.
28. Kathy J. Incidence of Cerebral Palsy Remains Constant in India on Indian Health News.[Internet].[Updated on 2010 Oct 04; Accessed on 2013 Jan 22].
29. American Academy of Pediatrics. Neonatal Encephalopathy and Neurologic Outcome, Second Edition Report of the American College of Obstetricians and Gynecologists' Task Force on Neonatal Encephalopathy. Pediatrics. 2014;133:1482-8.
30. Monokwane B, Johnson A, Gambrah-Sampaney C, et al. Risk factors for cerebral palsy in children in Botswana. Pediatric neurology. 2017;77:73-7.
31. Gulati S, Sondhi V. Cerebral palsy: an overview. The Indian Journal of Pediatrics. 2018;85:1006-16.
32. Vohr BR, Wright LL, Poole WK et al. Neurodevelopmental outcomes of extremely low birth weight infants< 32 weeks' gestation between 1993 and 1998. Pediatrics. 2005;116:635-43.
33. Escobar GJ, Littenberg B, Petitti DB. Outcome among surviving very low birthweight infants: a meta-analysis. Archives of disease in childhood. 1991;66:204-11
34. Krägeloh-Mann I, Cans C. Cerebral palsy update. Brain and development. 2009;31:537-44.

35. Wu YW, Croen LA, Shah SJ, et al. Cerebral palsy in a term population: risk factors and neuroimaging findings. Pediatrics. 2006;118:690-7.

36. Tollånes MC, Wilcox AJ, Lie RT, et al. Familial risk of cerebral palsy: population based cohort study. Bmj. 2014;349:g4294.

37. Sewell MD, Eastwood DM, Wimalasundera N. Managing common symptoms of cerebral palsy in children. bmj. 2014;349:g5474.

38. Jarvis S, Glinianaia SV, Arnaud C, et al. Case gender and severity in cerebral palsy varies with intrauterine growth. Archives of disease in childhood. 2005;90:474-9.

39. Kirton A, deVeber G. Paediatric stroke: pressing issues and promising directions. The Lancet Neurology. 2015;14:92-102.

40. Paulson A, Vargus-Adams J. Overview of four functional classification systems commonly used in cerebral palsy. Children. 2017;4:30.

41. Prechtl HF, Einspieler C, Cioni G, et al. An early marker for neurological deficits after perinatal brain lesions. The Lancet. 1997;349:1361-3.

42. Spittle AJ, Boyd RN, Inder TE, et al. Predicting motor development in very preterm infants at 12 months' corrected age: the role of qualitative magnetic resonance imaging and general movements assessments. Pediatrics. 2009;123:512-7.

43. Ashwal S, Russman BS, Blasco PA, et al. Practice parameter: diagnostic assessment of the child with cerebral palsy: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. Neurology. 2004;62:851-63.

44. Kliegman M, Stanton F B, St Geme J, et al. Nelson textbook of pediatrics. First south Asia ed. New Delhi: Elsevier Inc.Encephalopathies, Cerebral palsy;2896.

45. Novak I, Hines M, Goldsmith S, et al. Clinical prognostic messages from a systematic review on cerebral palsy. Pediatrics. 2012;130:1285-312.

46. Jones MW, Morgan E, Shelton JE, et al. Cerebral palsy: introduction and diagnosis (part I). Journal of Pediatric Health Care. 2007;21:146-52.

47. Harb A, Kishner S. Modified Ashworth Scale. 2020 May 31. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020. PMID: 32119459.

48. Hanna SE, Bartlett DJ, Rivard LM, et al. Reference curves for the Gross Motor Function Measure: percentiles for clinical description and tracking over time among children with cerebral palsy. Physical therapy. 2008;88:596-607.

49. DeMatteo C, Law M, Russell D, et al. The reliability and validity of the Quality of Upper Extremity Skills Test. Physical & Occupational Therapy in Pediatrics. 1993;13:1-8.

50. Thorley M, Lannin N, Cusick A, et al. Construct validity of the Quality of Upper Extremity Skills Test for children with cerebral palsy. Developmental Medicine & Child Neurology. 2012;54:1037-43.

51. Hirsh AT, Gallegos JC, Gertz KJ, et al. Symptom burden in individuals with cerebral palsy. Journal of rehabilitation research and development. 2010;47:863.

52. Jessen EC, Colver AF, Mackie PC, et al. Development and validation of a tool to measure the impact of childhood disabilities on the lives of children and their families. Child: Care, health and development. 2003;29:21-34.

53. Üstün TB, Chatterji S, Bickenbach J, et al. The International Classification of Functioning, Disability and Health: a new tool for understanding disability and health. Disability and rehabilitation. 2003;25:565-71.

54. Palisano R, Rosenbaum P, Walter S, et al. Development and reliability of a system to classify gross motor function in children with cerebral palsy. Developmental Medicine & Child Neurology. 1997;39:214-23.

55. Rosenbaum PL, Palisano RJ, Bartlett DJ, et al. Development of the gross motor function classification system for cerebral palsy. Developmental Medicine & Child Neurology. 2008;50:249-53.

56. Eliasson AC, Krumlinde- Sundholm L, Rösblad B, et al. The Manual Ability Classification System (MACS) for children with cerebral palsy: scale development and evidence of validity and reliability. Developmental medicine & child neurology. 2006;48:549-54.

57. Hidecker MJ, Paneth N, Rosenbaum PL, et al. Developing and validating the Communication Function Classification System for individuals with cerebral palsy. Developmental Medicine & Child Neurology. 2011;53:704-10.

58. Hirsh AT, Gallegos JC, Gertz KJ, et al. Symptom burden in individuals with cerebral palsy. Journal of rehabilitation research and development. 2010;47:863.

59. Ando N, Ueda S. Functional deterioration in adults with cerebral palsy. Clinical Rehabilitation. 2000;14:300-6.

60. Leigh S, Granby P, Turner M, et al. The incidence and implications of cerebral palsy following potentially avoidable obstetric complications: a preliminary burden of disease study. BJOG: An International Journal of Obstetrics& Gynaecology. 2014;121:1720-8.

61. Australia CP. The Economic Impact of Cerebral Palsy in Australia in 2007.

62. Centers for Disease Control and Prevention (CDC. Economic costs of birth defects and cerebral palsy-United States. Morbidity and mortality weekly report. 1995.22;44:694.

63. Honeycutt A, Dunlap L, Chen H. Economic costs associated with mental retardation, cerebral palsy, hearing loss, and visual impairment.. MMWR - Morbidity and Mortality Weekly Report.2003;53:57–59.

64. Tonmukayakul U, Shih ST, Bourke-Taylor H, et al. Systematic review of the economic impact of cerebral palsy. Research in developmental disabilities. 2018;80:93-101.

65. Kruse M, Michelsen SI, Flachs EM, et al. Lifetime costs of cerebral palsy. Developmental Medicine & Child Neurology. 2009;51:622-8.

66. Chang YT, Mu CH, Chin ZN, et al. The economic burden in children with developmental delay: a nationwide population-based case-control study. European Journal of Paediatric Neurology. 2013;17:S95.

67. Kancherla V, Amendah DD, Grosse SD, et al. Medical expenditures attributable to cerebral palsy and intellectual disability among Medicaid-enrolled children. Research in developmental disabilities. 2012 ;33:832-40.

68. Boyd RN, Davies PS, Ziviani J, et al. PREDICT-CP: study protocol of implementation of comprehensive surveillance to predict outcomes for school-aged children with cerebral palsy. BMJ open.2017;7:7.

69. Pareezer L, Jordan R, Ware R, et al. Cost of medical and allied health resource use and consequence in preschool age children with cerebral palsy: H4. Developmental Medicine & Child Neurology. 2012;54:71-2.

70. Hoving MA, Evers SM, Ament AJ, et al. Intractable spastic cerebral palsy in children: a Dutch cost of illness study. Dev Med Child Neurol. 2007;49:397-8.

71. Bourke- Taylor H, Howie L, Law M. Barriers to maternal workforce participation and relationship between paid work and health. Journal of Intellectual Disability Research. 2011;55:511-20.

72. Mendes P. Empowerment and Control in the Australian Welfare State: A critical analysis of Australian social policy since 1972. Routledge; 2018.

73. Fairhurst C. Cerebral palsy: the whys and hows. Archives of Disease in Childhood-Education and Practice. 2012 ;97:122-31.

74. DIN PC. International classification of functioning, disability and health..

75. Rosenbaum P, King S, Law M, King G, Evans J. Family-centred service: A conceptual framework and research review. Physical & Occupational Therapy in Pediatrics. 1998 ;18:1-20.

76. Aisen ML, Kerkovich D, Mast J, et al. Cerebral palsy: clinical care and neurological rehabilitation. The Lancet Neurology. 2011;10:844-52.

77. Darrah J, Law MC, Pollock N, et al. Context therapy: a new intervention approach for children with cerebral palsy. Developmental Medicine & Child Neurology. 2011;53:615-20.

78. Raina P, O'Donnell M, Rosenbaum P, et al. The health and well-being of caregivers of children with cerebral palsy. Pediatrics. 2005;115:626-36.

79. Kembhavi G, Darrah J, Payne K, et al. Adults with a diagnosis of cerebral palsy: a mapping review of long- term outcomes. Developmental Medicine & Child Neurology. 2011;53:610-4.

80. Tilton A. Management of spasticity in children with cerebral palsy. Semin Pediatr Neurol. 2009;16:82–9.

81. Sakzewski L, Ziviani J, Boyd R. Systematic review and meta-analysis of therapeutic management of upper-limb dysfunction in children with congenital hemiplegia. Pediatrics. 2009;123:1111-22.

82. Gordon AM, Hung YC, Brandao M, et al. Bimanual training and constraint-induced movement therapy in children with hemiplegic cerebral palsy: a randomized trial. Neurorehabilitation and neural repair. 2011;25:692-702.

83. Sakzewski L, Ziviani J, Abbott DF et al. Randomized trial of constraint- induced movement therapy and bimanual training on activity outcomes for children with congenital hemiplegia. Developmental Medicine & Child Neurology. 2011;53:313-20.

84. Huang HH, Fetters L, Hale J, et al. Bound for success: a systematic review of constraint-induced movement therapy in children with cerebral palsy supports improved arm and hand use. Physical therapy. 2009;89:1126-41.

85. Nascimento LR, Gloria AE, Habib ES. Effects of constraint-induced movement therapy as a rehabilitation strategy for the affected upper limb of children with hemiparesis: systematic review of the literature. Brazilian Journal of Physical Therapy. 2009;13:97-102.

86. Law MC, Darrah J, Pollock N, et al. Focus on function: a cluster, randomized controlled trial comparing child- versus context- focused intervention for young children with cerebral palsy. Developmental Medicine & Child Neurology. 2011;53(7):621-9.

87. Novak I, Cusick A, Lannin N. Occupational therapy home programs for cerebral palsy: double-blind, randomized, controlled trial. Pediatrics. 2009;124(4):606-14..

88. Löwing K, Bexelius A, Brogren Carlberg E. Activity focused and goal directed therapy for children with cerebral palsy–do goals make a difference?. Disability and rehabilitation. 2009;31:1808-16.

89. Dodd KJ, Taylor NF, Damiano DL. A systematic review of the effectiveness of strength-training programs for people with cerebral palsy. Archives of physical medicine and rehabilitation. 2002 ;83:1157-64.

90. Jeglinsky I, Surakka J, Carlberg EB, et al. Evidence on physiotherapeutic interventions for adults with cerebral palsy is sparse. A systematic review. Clinical Rehabilitation. 2010;24:771-88.

91. Mockford M, Caulton JM. Systematic review of progressive strength training in children and adolescents with cerebral palsy who are ambulatory. Pediatric Physical Therapy. 2008;20:318-33.

92. Harvey LA, Katalinic OM, Herbert RD, et al. Stretch for the treatment and prevention of contractures. Cochrane Database of Systematic Reviews. 2017.

93. Getz M, Hutzler Y, Vermeer A. Effects of aquatic interventions in children with neuromotor impairments: a systematic review of the literature. Clinical rehabilitation. 2006 ;20(11):927-36.

94. Gorter JW, Currie SJ. Aquatic exercise programs for children and adolescents with cerebral palsy: What do we know and where do we go?. International Journal of Pediatrics.2011; 24;.

95. Brown GT, Burns SA. The efficacy of neurodevelopmental treatment in paediatrics: a systematic review. British Journal of occupational therapy. 2001;64:235-44.

96. Snider L, Majnemer A, Darsaklis V. Feeding interventions for children with cerebral palsy: a review of the evidence. Physical & occupational therapy in pediatrics. 2011;31:58-77.

97. Arrowsmith F, Allen J, Gaskin K, et al. The effect of gastrostomy tube feeding on body protein and bone mineralization in children with quadriplegic cerebral palsy. Developmental Medicine & Child Neurology. 2010;52(11):1043-7.

98. Kong CK, Wong HS. Weight-for-height values and limb anthropometric composition of tube-fed children with quadriplegic cerebral palsy. Pediatrics. 2005;116:839-45.

99. Vernon- Roberts A, Sullivan PB. Fundoplication versus postoperative medication for gastro- oesophageal reflux in children with neurological impairment undergoing gastrostomy. Cochrane Database of systematic reviews. 2013(8).

100. Little SA, Kubba H, Hussain SS. An evidence- based approach to the child who drools saliva. Clinical Otolaryngology. 2009 ;34:236-9.

101. Greensmith AL, Johnstone BR, Reid SM, et al. Prospective analysis of the outcome of surgical management of drooling in the pediatric population: a 10-year experience. Plastic and reconstructive surgery. 2005 ;116:1233-42.

102. Stiller C, Marcoux BC, Olson RE. The effect of conductive education, intensive therapy, and special education services on motor skills in children with cerebral palsy. Physical & occupational therapy in pediatrics. 2003 ;2:31-50..

103. Bottos M, Bolcati C, Sciuto L, et al. Powered wheelchairs and independence in young children with tetraplegia. Developmental medicine & child neurology. 2001 ;43:769-77.

104. Zafeiriou DI, Kontopoulos EE, Tsikoulas I. Characteristics and prognosis of epilepsy in children with cerebral palsy. Journal of Child Neurology. 1999;14:289-94.

105. Parkinson KN, Gibson L, Dickinson HO, et al. Pain in children with cerebral palsy: a cross- sectional multicentre European study. Acta Paediatrica. 2010;99:446-51..

106. Parkinson KN, Dickinson HO, Arnaud C, et al.. Pain in young people aged 13 to 17 years with cerebral palsy: cross-sectional, multicentre European study. Archives of disease in childhood. 2013;98:434-40.

107. Castle K, Imms C, Howie L. Being in pain: a phenomenological study of young people with cerebral palsy. Developmental medicine & child neurology. 2007 ;49:445-9.

108. Pennington L, Goldbart J, Marshall J. Speech and language therapy to improve the communication skills of children with cerebral palsy. Cochrane Database of Systematic Reviews. 2004(2).

109. Dickinson HO, Parkinson KN, Ravens-Sieberer U et al. Self-reported quality of life of 8–12-year-old children with cerebral palsy: a cross-sectional European study. The Lancet. 2007;369:2171-8.

110. Dursun E, Dursun N, Alican D. Effects of biofeedback treatment on gait in children with cerebral palsy. Disability and rehabilitation. 2004 ;26:116-20.

111. Bloom R, Przekop A, Sanger TD. Prolonged electromyogram biofeedback improves upper extremity function in children with cerebral palsy. Journal of child neurology. 2010 ;25:1480-4.

112. Roebroeck ME, Jahnsen R, Carona C, et al. Adult outcomes and lifespan issues for people with childhood- onset physical disability. Developmental Medicine & Child Neurology. 2009 ;51:670-8.

113. Milla PJ, Jackson AD. A controlled trial of baclofen in children with cerebral palsy. Journal of International Medical Research. 1973 ;1:398-404.

114. Scheinberg A, Hall K, Lam LT, et al. Oral baclofen in children with cerebral palsy: A double- blind cross- over pilot study. Journal of paediatrics and child health. 2006 ;42:715-20.

115. Delgado MR, Hirtz D, Aisen M, et al. Practice parameter: pharmacologic treatment of spasticity in children and adolescents with cerebral palsy (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. Neurology. 2010;74:336-43..

116. Simpson DM, Gracies JM, Graham HK, et al. Assessment: Botulinum neurotoxin for the treatment of spasticity (an evidence-based review):[RETIRED]: Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Neurology. 2008;70:1691-8.

117. Friedman BC, Goldman RD. Use of botulinum toxin A in management of children with cerebral palsy. Canadian Family Physician. 2011 Sep 1;57(9):1006-73.

118. DuDley RW, Parolin M, Gagnon B, et al. Long-term functional benefits of selective dorsal rhizotomy for spastic cerebral palsy. Journal of Neurosurgery: Pediatrics. 2013 ;12(2):142-50..

119. Grunt S, Becher JG, Vermeulen RJ. Long- term outcome and adverse effects of selective dorsal rhizotomy in children with cerebral palsy: a systematic review. Developmental Medicine & Child Neurology. 2011;53:490-8.

120. Shore BJ, White N, Kerr Graham H. Surgical correction of equinus deformity in children with cerebral palsy: a systematic review. Journal of children's orthopaedics. 2010;4:277-90.

121. Blackmore AM, Boettcher- Hunt E, Jordan M, et al. A systematic review of the effects of casting on equinus in children with cerebral palsy: an evidence report of the AACPDM. Developmental Medicine & Child Neurology. 2007;49:781-90.

122. Carlson WE, Vaughan CL, Damiano DL, et al. Orthotic management of gait in spastic diplegia1. American journal of physical medicine & rehabilitation. 1997;76:219-25.

123. Wilson H, Haideri N, Song K, et al. Ankle-foot orthoses for preambulatory children with spastic diplegia. Journal of Pediatric Orthopaedics. 1997 ;17:370-6..

124. Albiol-Pérez S, Gómez JA, Olmo E, Soler AM. A virtual fine rehabilitation system for children with cerebral palsy: assesment of the usability of a low-cost system. InWorld Conference on Information Systems and Technologies 2017; :619-27

125. Koy A, Hellmich M, Pauls KA, et al. Effects of deep brain stimulation in dyskinetic cerebral palsy: a meta- analysis. Movement Disorders. 2013;28:647-54.

126. stamenova P, Koytchev R, Kuhn K et al.. A randomized, double- blind, placebo- controlled study of the efficacy and safety of tolperisone in spasticity following cerebral stroke. European journal of neurology. 2005 ;12:453-61.
127. Najar BA, Kachroo A, Gattoo IA, et al. Cerebral palsy: risk factors, comorbidities and associated MRI findings, a hospital based observational study. International Journal of Contemporary Pediatrics. 2015 ;2:90..
128. Vyas AG, Kori VK, Rajagopala S, et al. Etiopathological study on cerebral palsy and its management by Shashtika Shali Pinda Sweda and Samvardhana Ghrita. Ayu. 2013;34:56..
129. Dobhal M, Juneja M, Jain R, et al. Health-related quality of life in children with cerebral palsy and their families. Indian pediatrics. 2014 ;51:385-7.
130. YILMAZ YALÇINKAYA E, HÜNER B, et al. Demographic and Clinical Findings of Cerebral Palsy Patients in Istanbul: A Multicenter Study. Turkish Journal of Physical Medicine & Rehabilitation/Turkiye Fiziksel Tip ve Rehabilitasyon Dergisi. 2014;60(2).
131. Zhang H, Zhang B, Jia F, Liang D, Li H, et al. The effects of motor and intellectual functions on the effectiveness of comprehensive rehabilitation in young children with cerebral palsy. Journal of International Medical Research. 2015 ;43:125-38.
132. Amoghimath R, Gowda VK, Benakappa A. Comorbidities and their relationship to subtype of cerebral palsy in a tertiary care hospital in South India. Indian Journal of Cerebral Palsy. 2016 ;2:90.
133. Gowda VK, Kumar A, Shivappa SK, et al. Clinical profile, predisposing factors, and associated co-morbidities of children with cerebral palsy in South India. Journal of pediatric neurosciences. 2015;10:108.

134. Subramaniam ND, Jenifer A, Uma Devi et al. Etiology, outcomes and co-morbidities among cerebral palsy children attending tertiary care hospital, India: a prospective study. International Journal of Contemporary Pediatrics. 2019 May;6(3):1023.

135. Hollung SJ, Bakken IJ, Vik T, et al. Comorbidities in cerebral palsy: a patient registry study. Developmental Medicine & Child Neurology. 2020;62:97-103.

136. Bangash AS, Hanafi MZ, Idrees R, Zehra N. Risk factors and types of cerebral palsy. JPMA. The Journal of the Pakistan Medical Association.2014;64:103-7.

137. Mynarek M, Bjellmo S, Lydersen S, et al. Prelabor rupture of membranes and the association with cerebral palsy in term born children: a national registry-based cohort study. BMC Pregnancy and Childbirth. 2020;20(1):67.

138. Jain V, Jain J, Singh G, et al. Clinical Spectrum, Comorbidities, and Risk Factor Profile of Cerebral Palsy Children: A Prospective Study Perinatal risk factors in cerebral palsy: A rehab center based study. Indian journal of Cerebral Palsy.2015;1:75-79.

139. Minocha P, Sitaraman S, Sachdeva P. Clinical spectrum, comorbidities, and risk factor profile of cerebral palsy children: A prospective study. Journal of pediatric neurosciences. 2017;12:15..

140. Drougia A, Giapros V, Krallis N, Theocharis P, Nikaki A, Tzoufi M, Andronikou S. Incidence and risk factors for cerebral palsy in infants with perinatal problems: a 15-year review. Early human development. 2007 Aug 1;83(8):541-7.

141. Zhang H, Zhang B, Jia F, et al. The effects of motor and intellectual functions on the effectiveness of comprehensive rehabilitation in young children with cerebral palsy. Journal of International Medical Research. 2015 ;43:125-38.

142. Ploypetch T, Kwon JY, Armstrong HF, et al. Gross Motor Function Improvement in Children with Cerebral Palsy: A Case Series of Single-Event Multi-Level Chemoneurolysis Using Botulinum Toxin-A and/or Phenol Injections. Int J Physiatry. 2015;1(001).

143. Rutz E, Tirosh O, Thomason PA, Barg A, Graham HK. Stability of the Gross Motor Function Classification System after single- event multilevel surgery in children with cerebral palsy. Developmental Medicine & Child Neurology. 2012 Dec;54(12):1109-13.

144. Navarrete-Opazo AA, Gonzalez W, Nahuelhual P. Effectiveness of oral baclofen in the treatment of spasticity in children and adolescents with cerebral palsy. Archives of physical medicine and rehabilitation. 2016;97:604-18.

145. Luo D, Wu G, Ji Y, Zhang Z, He F, Mou X, Zhu Q, Yang B. RETRACTED: The comparative study of clinical efficacy and safety of baclofen vs tolperisone in spasticity caused by spinal cord injury.

146. McKinlay I, Hyde E, Gordon N. Baclofen: a team approach to drug evaluation of spasticity in childhood. Scottish Medical Journal. 1980 ;25(4):S26-8.

ANNEXURE I – CONSENT FORM

"Comparative study of clinical efficacy of tolperisonevs baclofen in spastic cerebral palsy children: 1 year randomized controlled trial at KLES DrPrabhakarkore charitable hospital"

Objective and purpose of the study

This research is intended to comparethe improvement in spasticity by administration of baclofen and tolperisonein cerebral palsy children more than 1 yearof age.

Procedure

If you agree for your child to be part of the research study he/she will be asked the relevant history and will be subjected to relevant clinical examination.There are some questionnaires needs to be answered by the parents preferably mother and intervention is done in the form of administrating drugs for treatment of spasticity.

Riskand Benefits

The only risk and possible discomfort he/she might get is due to the side effects of drugs and it includes nausea ,vomiting drowsiness , confusion and if serious supportive measures will be taken.

Alternatives

Taking part in this study is voluntary. You may choose your child not to take part in this study, or if you decide your child to take part you can later change your mind and withdraw from the study. Your decision will not change the present or future

health care or other services that your child will receive. The study doctor may stop his/her participation in this study any time.

Privacy and Confidentiality

All information collected about your child during the course of this study will be kept confidential to the extent permitted by law. The code numbers will identify me in this research record. Information from this study may be published but my identity will be confidential in any publication.

Financial incentives for participation

Your child will not be paid / offered any gifts /incentives for participating in the study.

Authorization to publish the results

The results of the study would be forwarded to the KLEUniversity, Belgaum as part of requirement towards the completion of MD degree, review, and publishing.

If you have any questions about your child's rights as a participants parent/ guardian you may call Dr.RoopaM Bellad, professor Department of Paediatrics,J.N.M.C Ethical Committee for Human Research phone number 0831-247135.,

Consent Statement

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My signature below indicates that I have read, or it has been read to me, this entire consent form, and have had all my questions answered.

Name of the Participant or legally authorized representative:_____

Signature / Thumb print _____

In case of the queries during study or in future you may contact following person.

Principal investigator :

Co investigator :

Name of the Witness _____

Signature _____

Investigator Name and Signature _____

Date: Place:

ANNEXURE-II

PROFORMA

Proforma for the study

- Name:
- Age:
- sex:
- Date of evaluation:
- Phone no:
- Presenting complaints: Developmental delay
    - Motor - yes / no
    - Social-yes/no
    - Language- yes/no
- Neurological co morbidities:
    - Behavioural-yes/no
    - Seizures- yes/no
    - Visual abnormality-yes/no
    - Hearing-yes/no
- Non neurological co-morbidity:
    - Drooling-yes/no
    - Deformity-yes/no
    - Dental caries-yes/no
    - Vomiting/constipation-yes/no

- Family history /Birth history:
    - Consanguinity:yes/no,if yes 1st /2nd /3rd
    - Birth order:
    - ANC visits: yes/no
    - Gestation: Term/Preterm
    - Place of delivery: Hospital/Home
    - Mode of delivery:NVD/LSCS
    - PROM:Yes/ No
    - Multiple pregnancy: yes/no
    - Cry at birth:Normal/Delayed
    - Birth weight:
    - NICU stay: yes/no
- DEVELOPMENTAL MILESTONES

1.GROSS MOTOR	age	2.FINE MOTOR	Age
a.Neck holding		a.Bidextrous reach	
b.Rolling over		b.Immature Pincer grasp	
c.Sits with support		c.Pincer grasp	
d.Sits without support		d.Tower of 2	
e.Stands		e.Tower of 6	
f.Walks		f.Tower of 9	
DQ/IQ		DQ/IQ	

3.social	age	4.language	age
a.Social smile		a.Alert to sound	
b.Recognizes mother		b .Coos	
c.Stranger anxiety		c.Monosyllables	
d.Waves bye bye		d.Bisyllables	
e.Copies parents in tasks		e.1-2words	
f.Goes to toilet alone		f.2-3 words sentences	
DQ		DQ	

- Examination:

o Vital signs :

a.HR: b. RR: c. BP: d.Hydration:

o CENTRAL NERVOUS SYSTEM:

1.Interaction with examiner	a.Good	b.Fair	c. Poor	
2.Interest in the surroundings	a.Good	b. Fair	c.Poor	
3.Schooling	a.Normal	b.Special school	c. No school	
4.Behavioural problems	a.hyper active	b.autistic	c.apathy	d.depressed
5.Speech and articulation				
6.Cranial nerves				

- Motor system:

31.Body part	Tone	Voluntary contractions
1.shoulder	i.normal,ii.increased,iii.decreased	i. yes, ii.no
2.elbow		
3.wrist		
4.hand		
5.hip		
6.knee		
7.ankle		

- Gait: a. possible b. not possible

1. Hop 2.Tandem walk 3.Toe walk 4. Kneel walk

- Deep tendon reflexes

a.Supinator	i.normal,ii.increased,iii.decreased
b.Triceps	
c.Biceps	
d.Knee	
e.Ankle	

- Other system:

a.CVS:

b. RS:

c. P/A:

- Topographical classification: Diplegic/Hemiplegic/Quadriplegic
- Physiological classification: Spastic/Mixed
- GMFCS classification: ClassI/ClassII/ClassIII/ClassIV/ClassV
- CLINICAL EVALUATION

COMPONENTS	PRE INTERVENTION	POST INTERVENTION
MAS		
Elbow		
Wrist		
Hamstrings		
Quadriceps		
Gastronimeus		
Soleus		

COMPONENTS	PRE INTERVENTION	POST INTERVENTION

QUEST		
Dissociative		
Grasp		
Weight bearing		
Protective		
Total		

COMPONENTS	PRE INTERVENTION	POST INTERVENTION
GMFM		

COMPONENTS	PRE INTERVENTION	POST INTERVENTION
CPQOL		

- Adverse effects:
  - Constipation: yes/no
  - Drowsiness: yes/no
  - Weakness: yes/no
  - Dry mouth: yes/no
  - Diarrhea: yes/no
  - Anorexia:yes/no
- Intervention advised: Drug therapy

- Dose of baclofen is – would be started at 0.5mg/kg in three divided dose and then increased to 1mg/kg/day
- Tolperisone dose- <6years -2.5mg/kg/day in three doses, would be increased to 5mg/kg/day 6-14 years – 2mg /kg/day in three doses,increased to 4mg/kg/day.[7]

ANNEXURE III-QUEST SCORE SHEET

QUEST©

Quality of Upper Extremity Skills Test

Carol DeMatteo, Mary Law, Dianne Russell, Nancy Pollock, Peter Rosenbaum, Stephen Walter

Child's Name: _____ Date: _____ (year/month/day) Time of Day: _____

Evaluator: _____ Age: _____ years _____ months

Testing Conditions:

Room _____

Seating (e.g., insert) _____

Table (e.g., cutout) _____

Orthotics (e.g., splints/AFOs) _____

Others Present (e.g., parent) _____

Score Key

✔ = Yes (able to complete item according to specification)

✘ = No (can not or will not complete item)

NT = Not Tested (not able to administer item)

*If a complete section is not tested, insert **NT** in summary score*

MAKE SURE THERE IS A SCORE ENTERED IN EVERY SCORING BOX

SUMMARY SCORE (transfer from QUEST Scoring Sheet)

A:	DISSOCIATED MOVEMENTS	
B:	GRASPS	
C:	WEIGHT BEARING	
D:	PROTECTIVE EXTENSION	

$$\text{TOTAL SCORE} = \frac{\text{SUM OF SCORES FOR EACH SECTION TESTED}}{\text{TOTAL \# OF SECTIONS TESTED}}$$

_____

QUEST *Scoring Sheet*

A. DISSOCIATED MOVEMENTS

1. Transfer score information from page 6 of QUEST.

Total ✔ = ☐ = a

Total ✘ = ☐ = b

Total NT = ☐ x 2 = c

2. Calculate unstandardized score.

$$\text{Score A} = \frac{2(a) + b}{128 - c} \times 100$$

c **a** is multiplied by 2 because each ✔ scores 2 points.

$$\text{Score A} = \frac{2(\quad) + (\quad)}{128 - (\quad)} \times 100$$

c The **128 - c** calculation adjusts the score for any items not tested.

Score A = ☐

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score A - 50) x 2 = (- 50) x 2 = ☐

This is the dissociated movements score and can be transferred to the front page of the QUEST.

i.

B. GRASP

1. Transfer score information on sitting posture from page 7.

Total Normal = ☐ x 2 = d

Total Atypical = ☐ x (-1) = e

Score B1 = d + e = ☐

2. Transfer score information on grasps from page 10.

Total ✔ = ☐ = f

Total ✘ = ☐ = g

Total NT = ☐ x 2 = h

3. Calculate unstandardized score.

$$\text{Score B} = \frac{\text{Score B1} + 2(\text{f}) + \text{g}}{54 - \text{h}} \times 100$$

c The **54 - h** calculation adjusts the score for any items not tested.

$$\text{Score B} = \frac{(\quad) + 2(\quad) + (\quad)}{54 - (\quad)} \times 100$$

Score B = ☐

c Round to two decimal points.

4. Obtain a standardized score ranging from below zero (if a child scores ✘ on all items and has atypical posture) to 100.

(Score B - 50) x 2 = (- 50) x 2 = ☐

This is the grasps score and can be transferred to the front page of the QUEST.

ii.

C. WEIGHT BEARING

1. Transfer score information from page 12 of QUEST.

Total ✔ = ☐ = i

Total ✘ = ☐ = j

Total NT = ☐ x 2 = k

2. Calculate unstandardized score.

$$\text{Score C} = \frac{2(\text{i}) + \text{j}}{100 - \text{k}} \times 100$$

c The **100 - k** calculation adjusts the score for any items not tested.

$$\text{Score C} = \frac{2(\quad) + (\quad)}{100 - (\quad)} \times 100$$

Score C = ☐

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score C - 50) x 2 = (- 50) x 2 = ☐

This is the weight bearing score and can be transferred to the front page of the QUEST.

D. PROTECTIVE EXTENSION

1. Transfer score information from page 13 of QUEST.

Total ✔	= [ ]		= l
Total ✘	= [ ]		= m
Total NT	= [ ]	x 2	= n

2. Calculate unstandardized score.

$$\text{Score D} = \frac{2(l) + m}{72 - n} \times 100$$

c The **72 - n** calculation adjusts the score for any items not tested.

$$\text{Score D} = \frac{2(\quad) + (\quad)}{72 - (\quad)} \times 100$$

Score D = [ ]

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score D - 50) x 2 = (- 50) x 2 = [ ]

This is the protective extension score and can be transferred to the front page of the QUEST.

ANNEXURE IV-GMFM SCORE SHEET

GROSS MOTOR FUNCTION MEASURE (GMFM)
SCORE SHEET (GMFM-88 and GMFM-66 scoring)

Child's Name: _____ ID#: _____

Assessment Date: _____ (year / month / day)

GMFCS Level[1]

☐ I ☐ II ☐ III ☐ IV ☐ V

Date of Birth: _____ (year / month / day)

Chronological Age: _____ (year / month / day)

Evaluator's Name: _____

Testing Condition (e.g., room, clothing, time, others present):

_____

The GMFM is a standardized observational instrument designed and validated to measure change in gross motor function over time in children with cerebral palsy. The scoring key is meant to be a general guideline. However, most of the items have specific descriptors for each score. It is imperative that the guidelines contained in the manual be used for scoring each item.

SCORING KEY

0 = does not initiate
1 = initiates
2 = partially completes
3 = completes
9 (or leave blank) = not tested (NT) [used for the GMAE-2 scoring*]

It is important to differentiate a true score of "0" (child does not initiate) from an item which is Not Tested (NT) if you are interested in using the GMFM-66 Ability Estimator (GMAE) Software.

*The GMAE-2 software is available for downloading from www.canchild.ca for those who have purchased the GMFM manual. The GMFM-66 is only valid for use with children who have cerebral palsy.

Contact for Research Group:
CanChild Centre for Childhood Disability Research,
Institute for Applied Health Sciences, McMaster University,
1400 Main St. W., Room 408,
Hamilton, ON Canada L8S 1C7
Email: canchild@mcmaster.ca Website: www.canchild.ca

CanChild
Centre for Childhood Disability Research

[1]GMFCS level is a rating of severity of motor function. Definitions for the GMFCS-E&R (expanded & revised) are found in Palisano et al. (2008). Developmental Medicine & Child Neurology, 50:744-750 and in the GMAE-2 scoring software. http://motorgrowth.canchild.ca/en/GMFCS/resources/GMFCS-ER.pdf

Check (3) the appropriate score: if an item is not tested (NT), circle the item number on the right column

Item		A: LYING & ROLLING	SCORE				NT
	1.	SUP, HEAD IN MIDLINE: TURNS HEAD WITH EXTREMITIES SYMMETRICAL	0☐	1☐	2☐	3☐	1.
*	2.	SUP: BRINGS HANDS TO MIDLINE, FINGERS ONE WITH THE OTHER	0☐	1☐	2☐	3☐	2.
	3.	SUP: LIFTS HEAD 45°	0☐	1☐	2☐	3☐	3.
	4.	SUP: FLEXES R HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	4.
	5.	SUP: FLEXES L HIP & KNEE THROUGH FULL RANGE	0☐	1☐	2☐	3☐	5.
*	6.	SUP: REACHES OUT WITH R ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	6.
*	7.	SUP: REACHES OUT WITH L ARM, HAND CROSSES MIDLINE TOWARD TOY	0☐	1☐	2☐	3☐	7.
	8.	SUP: ROLLS TO PR OVER R SIDE	0☐	1☐	2☐	3☐	8.
	9.	SUP: ROLLS TO PR OVER L SIDE	0☐	1☐	2☐	3☐	9.
*	10.	PR: LIFTS HEAD UPRIGHT	0☐	1☐	2☐	3☐	10.
	11.	PR ON FOREARMS: LIFTS HEAD UPRIGHT, ELBOWS EXT., CHEST RAISED	0☐	1☐	2☐	3☐	11.
	12.	PR ON FOREARMS: WEIGHT ON R FOREARM, FULLY EXTENDS OPPOSITE ARM FORWARD	0☐	1☐	2☐	3☐	12.
	13.	PR ON FOREARMS: WEIGHT ON L FOREARM, FULLY EXTENDS OPPOSITE ARM FORWARD	0☐	1☐	2☐	3☐	13.
	14.	PR: ROLLS TO SUP OVER R SIDE	0☐	1☐	2☐	3☐	14.
	15.	PR: ROLLS TO SUP OVER L SIDE	0☐	1☐	2☐	3☐	15.
	16.	PR: PIVOTS TO R 90° USING EXTREMITIES	0☐	1☐	2☐	3☐	16.
	17.	PR: PIVOTS TO L 90° USING EXTREMITIES	0☐	1☐	2☐	3☐	17.
		TOTAL DIMENSION A					

Item		B: SITTING	SCORE				NT
*	18.	SUP, HANDS GRASPED BY EXAMINER: PULLS SELF TO SITTING WITH HEAD CONTROL	0☐	1☐	2☐	3☐	18.
	19.	SUP: ROLLS TO R SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	19.
	20.	SUP: ROLLS TO L SIDE, ATTAINS SITTING	0☐	1☐	2☐	3☐	20.
*	21.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD UPRIGHT, MAINTAINS 3 SECONDS	0☐	1☐	2☐	3☐	21.
*	22.	SIT ON MAT, SUPPORTED AT THORAX BY THERAPIST: LIFTS HEAD MIDLINE, MAINTAINS 10 SECONDS	0☐	1☐	2☐	3☐	22.
*	23.	SIT ON MAT, ARM(S) PROPPING: MAINTAINS, 5 SECONDS	0☐	1☐	2☐	3☐	23.
*	24.	SIT ON MAT: MAINTAIN, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	24.
*	25.	SIT ON MAT WITH SMALL TOY IN FRONT: LEANS FORWARD, TOUCHES TOY, RE-ERECTS WITHOUT ARM PROPPING	0☐	1☐	2☐	3☐	25.
*	26.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S R SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	26.
*	27.	SIT ON MAT: TOUCHES TOY PLACED 45° BEHIND CHILD'S L SIDE, RETURNS TO START	0☐	1☐	2☐	3☐	27.
	28.	R SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	28.
	29.	L SIDE SIT: MAINTAINS, ARMS FREE, 5 SECONDS	0☐	1☐	2☐	3☐	29.
*	30.	SIT ON MAT: LOWERS TO PR WITH CONTROL	0☐	1☐	2☐	3☐	30.
*	31.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER R SIDE	0☐	1☐	2☐	3☐	31.
*	32.	SIT ON MAT WITH FEET IN FRONT: ATTAINS 4 POINT OVER L SIDE	0☐	1☐	2☐	3☐	32.
	33.	SIT ON MAT: PIVOTS 90°, WITHOUT ARMS ASSISTING	0☐	1☐	2☐	3☐	33.
*	34.	SIT ON BENCH: MAINTAINS, ARMS AND FEET FREE, 10 SECONDS	0☐	1☐	2☐	3☐	34.
*	35.	STD: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	35.
*	36.	ON THE FLOOR: ATTAINS SIT ON SMALL BENCH	0☐	1☐	2☐	3☐	36.
*	37.	ON THE FLOOR: ATTAINS SIT ON LARGE BENCH	0☐	1☐	2☐	3☐	37.
		TOTAL DIMENSION B					

Item		C: CRAWLING & KNEELING	SCORE				NT
	38.	PR: CREEPS FORWARD 1.8m (6')	0☐	1☐	2☐	3☐	38.
*	39.	4 POINT: MAINTAINS WEIGHT ON HANDS AND KNEES, 10 SECONDS	0☐	1☐	2☐	3☐	39.
*	40.	4 POINT: ATTAINS SIT ARMS FREE	0☐	1☐	2☐	3☐	40.
*	41.	PR: ATTAINS 4 POINT, WEIGHT ON HANDS AND KNEES	0☐	1☐	2☐	3☐	41.
*	42.	4 POINT: REACHES FORWARD WITH R ARM, HAND ABOVE SHOULDER LEVEL	0☐	1☐	2☐	3☐	42.
*	43.	4 POINT: REACHES FORWARD WITH L ARM, HAND ABOVE SHOULDER LEVEL	0☐	1☐	2☐	3☐	43.
*	44.	4 POINT: CRAWLS OR HITCHES FORWARD 1.8m(6')	0☐	1☐	2☐	3☐	44.
*	45.	4 POINT: CRAWLS RECIPROCALLY FORWARD1.8m (6')	0☐	1☐	2☐	3☐	45.
*	46.	4 POINT: CRAWLS UP 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	46.
	47.	4 POINT: CRAWLS BACKWARDS DOWN 4 STEPS ON HANDS AND KNEES/FEET	0☐	1☐	2☐	3☐	47.
*	48.	SIT ON MAT: ATTAINS HIGH KN USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	48.
	49.	HIGH KN: ATTAINS HALF KN ON R KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	49.
	50.	HIGH KN: ATTAINS HALF KN ON L KNEE USING ARMS, MAINTAINS, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	50.
*	51.	HIGH KN: KN WALKS FORWARD 10 STEPS, ARMS FREE	0☐	1☐	2☐	3☐	51.
		TOTAL DIMENSION C					

Item		D: STANDING	SCORE				NT
*	52.	ON THE FLOOR: PULLS TO STD AT LARGE BENCH	0☐	1☐	2☐	3☐	52.
*	53.	STD: MAINTAINS, ARMS FREE, 3 SECONDS	0☐	1☐	2☐	3☐	53.
*	54.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS R FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	54.
*	55.	STD: HOLDING ON TO LARGE BENCH WITH ONE HAND, LIFTS L FOOT, 3 SECONDS	0☐	1☐	2☐	3☐	55.
*	56.	STD: MAINTAINS, ARMS FREE, 20 SECONDS	0☐	1☐	2☐	3☐	56.
*	57.	STD: LIFTS L FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	57.
*	58.	STD: LIFTS R FOOT, ARMS FREE, 10 SECONDS	0☐	1☐	2☐	3☐	58.
*	59.	SIT ON SMALL BENCH: ATTAINS STD WITHOUT USING ARMS	0☐	1☐	2☐	3☐	59.
*	60.	HIGH KN: ATTAINS STD THROUGH HALF KN ON R KNEE, WITHOUT USING ARMS	0☐	1☐	2☐	3☐	60.
*	61.	HIGH KN: ATTAINS STD THROUGH HALF KN ON L KNEE, WITHOUT USING ARMS	0☐	1☐	2☐	3☐	61.
*	62.	STD: LOWERS TO SIT ON FLOOR WITH CONTROL, ARMS FREE	0☐	1☐	2☐	3☐	62.
*	63.	STD: ATTAINS SQUAT, ARMS FREE	0☐	1☐	2☐	3☐	63.
*	64.	STD: PICKS UP OBJECT FROM FLOOR, ARMS FREE, RETURNS TO STAND	0☐	1☐	2☐	3☐	64.
		TOTAL DIMENSION D					

Item		E: WALKING, RUNNING & JUMPING	SCORE				NT
*	65.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO R	0☐	1☐	2☐	3☐	65.
*	66.	STD, 2 HANDS ON LARGE BENCH: CRUISES 5 STEPS TO L	0☐	1☐	2☐	3☐	66.
*	67.	STD, 2 HANDS HELD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	67.
*	68.	STD, 1 HAND HELD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	68.
*	69.	STD: WALKS FORWARD 10 STEPS	0☐	1☐	2☐	3☐	69.
*	70.	STD: WALKS FORWARD 10 STEPS, STOPS, TURNS 180°, RETURNS	0☐	1☐	2☐	3☐	70.
*	71.	STD: WALKS BACKWARD 10 STEPS	0☐	1☐	2☐	3☐	71.
*	72.	STD: WALKS FORWARD 10 STEPS, CARRYING A LARGE OBJECT WITH 2 HANDS	0☐	1☐	2☐	3☐	72.
*	73.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS BETWEEN PARALLEL LINES 20cm (8")APART	0☐	1☐	2☐	3☐	73.
*	74.	STD: WALKS FORWARD 10 CONSECUTIVE STEPS ON A STRAIGHT LINE 3cm (1¼") WIDE	0☐	1☐	2☐	3☐	74.
*	75.	STD: STEPS OVER STICK AT KNEE LEVEL, R FOOT LEADING	0☐	1☐	2☐	3☐	75.
*	76.	STD: STEPS OVER STICK AT KNEE LEVEL, L FOOT LEADING	0☐	1☐	2☐	3☐	76.
*	77.	STD: RUNS 4.5m (15'), STOPS & RETURNS	0☐	1☐	2☐	3☐	77.
*	78.	STD: KICKS BALL WITH R FOOT	0☐	1☐	2☐	3☐	78.
*	79.	STD: KICKS BALL WITH L FOOT	0☐	1☐	2☐	3☐	79.
*	80.	STD: JUMPS 30cm (12") HIGH, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	80.
*	81.	STD: JUMPS FORWARD 30 cm (12"), BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	81.
*	82.	STD ON R FOOT: HOPS ON R FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE	0☐	1☐	2☐	3☐	82.
*	83.	STD ON L FOOT: HOPS ON L FOOT 10 TIMES WITHIN A 60cm (24") CIRCLE	0☐	1☐	2☐	3☐	83.
*	84.	STD, HOLDING 1 RAIL: WALKS UP 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	84.
*	85.	STD, HOLDING 1 RAIL: WALKS DOWN 4 STEPS, HOLDING 1 RAIL, ALTERNATING FEET	0☐	1☐	2☐	3☐	85.
*	86.	STD: WALKS UP 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	86.
*	87.	STD: WALKS DOWN 4 STEPS, ALTERNATING FEET	0☐	1☐	2☐	3☐	87.
*	88.	STD ON 15cm (6") STEP: JUMPS OFF, BOTH FEET SIMULTANEOUSLY	0☐	1☐	2☐	3☐	88.

TOTAL DIMENSION E ☐

Was this assessment indicative of this child's "regular" performance? YES ☐ NO ☐

COMMENTS:

GMFM-88 SUMMARY SCORE

DIMENSION	CALCULATION OF DIMENSION % SCORES	GOAL AREA (indicated with ✓ check)
A. Lying & Rolling	$\frac{\text{Total Dimension A}}{51} = \frac{\quad}{51} \times 100 = \quad\%$	A. ☐
B. Sitting	$\frac{\text{Total Dimension B}}{60} = \frac{\quad}{60} \times 100 = \quad\%$	B. ☐
C. Crawling & Kneeling	$\frac{\text{Total Dimension C}}{42} = \frac{\quad}{42} \times 100 = \quad\%$	C. ☐
D. Standing	$\frac{\text{Total Dimension D}}{39} = \frac{\quad}{39} \times 100 = \quad\%$	D. ☐
E. Walking, Running & Jumping	$\frac{\text{Total Dimension E}}{72} = \frac{\quad}{72} \times 100 = \quad\%$	E. ☐

$$\text{TOTAL SCORE} = \frac{\%A + \%B + \%C + \%D + \%E}{\text{Total \# of Dimensions}}$$

$$= \frac{\quad}{5} = \quad = \quad\%$$

$$\text{GOAL TOTAL SCORE} = \frac{\text{Sum of \%scores for each dimension identified as a goal area}}{\text{\# of Goal areas}}$$

$$= \quad = \quad\%$$

GMFM-66 Gross Motor Ability Estimator Score [1]

GMFM-66 Score = _____ _____ to _____ 95% Confidence Intervals

previous GMFM-66 Score = _____ _____ to _____ 95% Confidence Intervals

change in GMFM-66 = _____

[1] from the Gross Motor Ability Estimator (GMAE-2) Software

ANNEXURE V-LAQ-CP SCORE SHEET

APPENDIX 2

LAQ-CP WITH SCORING KEY

The scoring key has been included in the questionnaire here, although usually it is held separately. We have also omitted the introductory front sheet.

Parents generally complete the questionnaire very thoroughly. However, occasionally a question is left blank, and a score of 0 is then assigned. If more than 5 questions have been left blank, the LAQ-CP becomes invalid.

1. How many times has your child been seen over the **last year** by a doctor other than the school doctor or your family doctor? (Please circle one of the following)

	0	1	2-5	6-12	13+
Score	*0*	*1*	*2*	*3*	*4*

2. Has your child had to stay in hospital for any length of time **over the last year**? Please indicate in **weeks** the total amount of time spent in hospital. (Please circle one of the following)

	0	<1	1-3	4-26	27+
Score	*0*	*1*	*2*	*3*	*4*

3. How many operations have been carried out on your child **over the last year**? (Please circle one of the following)

	0	1	2	3	4+
Score	*0*	*1*	*2*	*3*	*4*

4. Has your child had a leg, arm or other part of his/her body in plaster **over the last year**? Please indicate in **weeks** the total time your child has spent in plaster. (Please circle one of the following)

	0	<6	7-11	12-17	18+
Score	*0*	*1*	*2*	*3*	*4*

5. Has your child had to wear some form of body or leg support **over the last year?** Please indicate in **weeks** the total time the support was worn. (Please circle one of the following)

	0	1-16	17-32	33-51	52
Score	*0*	*1*	*2*	*3*	*4*

6. How many tablets, pills or doses of medicines did your child take **yesterday**? (Please circle one of the following)

	0	1-4	5-8	9-12	13+
Score	*0*	*1*	*2*	*3*	*4*

7. Is your child currently receiving a special diet for any reason? (Please circle one of the following)

	YES	NO
Score	*4*	*0*

8. How many times has your child suffered from any fits or blackouts **over the last year**? (Please circle one of the following)

	Score
No Fits at all	*0*
Occasional fit during day averaging one per month	*1*
Some fits most weeks day or night	*2*
Many fits on most days and nights	*3*
Constant fits in frequent succession	*4*

9. Has your child been seen by a specialist about difficulties with his/her behaviour **over the last year**? (Please circle one of the following)

	YES	NO
Score	*4*	*0*

10. How often has your child been seen by any sort of therapist **over the last year**? (Please circle one of the following)

	0	1	2-12	13-52	53+
Score	*0*	*1*	*2*	*3*	*4*

11. Which of the following services/allowances is your child currently receiving?
(Please circle all of those currently received)

Visits from Health Visitor	Visits from Home Help	Visits from Social worker
Visits from Community Nurse	Voluntary Services	

Number of services provided	*0*	*1-2*	*3+*
Score	*0*	*2*	*4*

12. How many items of special equipment are there in the home which are currently, or have been, essential for your child?
(Please circle one of the following)

	0	1-3	4-7	8-10	11+
Score	*0*	*1*	*2*	*3*	*4*

13. What has been the financial cost to the family for your child **over the last year** in purchasing and maintaining such special equipment? (Please circle one of the following)

	£0	£1-100	£101-200	£201-300	£301+
Score	*0*	*1*	*2*	*3*	*4*

14. What has been the extra financial cost to the family **over the last year** other than in purchasing special equipment, which was not covered fully by grants and allowances? (Please circle one of the following)

	£0	£1-100	£101-200	£201-300	£301+
Score	*0*	*1*	*2*	*3*	*4*

15. Has your child's present home been adapted in any way **over the last year** because of your child?
(Please circle one of the following)

YES	NO
	0

If yes how many adaptations have been made? (Please circle one of the following)

	1-3	4-7	8-10	11+
Score	*1*	*2*	*3*	*4*

16. Please indicate how many (further) adaptations are planned or are considered necessary?
(Please circle one of the following)

	0	1-3	4-7	8-10	11+
Score	*0*	*1*	*2*	*3*	*4*

17. For each of the following activities, please tick **one** of the spaces to indicate how much help you would normally give to your child to complete that activity

	No Help given	Some help/ supervision given	Has to be done for him/her
Washing hands			
Eating a bowl of cereal			
Putting on a vest/T-shirt			
Doing up buttons or buckles			
Getting out of bed			
Getting out of the bath			
Going to the toilet			
Climbing stairs			
Getting in and out of a car			
Opening doors			
Picking up an object from the floor			
Carrying a drink the length of a room			

Score

		No Help	*Some Help*	*Has to be done for them*
(a)	*Washing hands*	*0*	*2*	*4*
(b)	*Eating cereal*	*0*	*2*	*4*
(c)	*T-shirt*	*0*	*2*	*4*
(d)	*Buttons/ Buckles*	*0*	*2*	*4*
(e)	*Getting out of bed*	*0*	*2*	*4*
(f)	*Getting out of bath*	*0*	*2*	*4*
(g)	*Toilet*	*0*	*2*	*4*
(h)	*Climbing stairs*	*0*	*2*	*4*
(i)	*In/out of car*	*0*	*2*	*4*

(Total possible score)

17 (x – xii) renders one score as follows:

Opening doors	0	2	4
Picking up objects	0	2	4
Carry drinks	0	2	4

Add the values for 17 (x – xii) and assign final score as follows:

Added Value	0	2	4-6	8-10	12
Score	0	1	2	3	4

18. How many times did you need to lift your child on the last occasion you spent a **full day** with him/her?

Multiply the number of lifts from this question by the appropriate weight on the front sheet.

If weight given in stones and pounds, convert to stones and round up or down to one decimal point. Score the product as follows:

	< 0.5	=	*0*
	0.5 - 9.4	=	*1*
	9.5 - 22.4	=	*2*
	22.5 – 43.9	=	*3*
	44 +	=	*4*

If weight given in kilograms and grams, convert to kilograms and round up or down to one decimal point. Score the product as follows:

	< 3.2	=	*0*
	3.2 – 60.4	=	*1*
	60.5 – 143	=	*2*
	143.1 – 279.9	=	*3*
	280 +	=	*4*

19. How often has your child required assistance during the night **over the last week**? (Please circle one of the following)

	0	1-3	4-7	8-10	11+
Score	*0*	*1*	*2*	*3*	*4*

20. Please list any other areas where your child requires assistance in the course of a normal day?

Score	*No areas noted*	=	*0*
	1 area noted	=	*1*
	2 areas noted	=	*2*
	3+ areas noted	=	*3*
	Constant supervision	=	*4*

21. (a) How many rooms (excluding halls and passages) are there in your child's usual place of residence ?
(b) Over the **past week**, how many of these did your child go into?
(c) How many of these did your child enter unassisted?

Score Two scores are calculated for this question: ACCESS 1 and ACCESS 3

Calculate ACCESS 1 by using the values given for 21a and 21b as follows.
Multiple 21b by 100 and divide the product by 21a
Score as follows:

100	=	*0*
75 – 99	=	*1*
50 – 74	=	*2*
25 – 49	=	*3*
0 – 24	=	*4*

Calculate ACCESS 3 by using the values given for 21b and 21c as follows:
If 21c = 0, then score 4
If 21c = 1 or more, then multiple 21c by 100 and divide the product by 21b
Score as follows:

100	=	*0*
66.6 – 99.9	=	*1*
33.4 – 66.5	=	*2*
1 – 33.3	=	*3*

22. Does you child normally need help in getting in and out of the house? (Please circle one of the following)

	YES	**NO**
Score	*4*	*0*

23. What is the furthest distance your child has gone outside without assistance **over the past week?**
(Please circle one of the following)

	0	1-100 yards	101-440 yards	1/4 - 1/2 mile	1/2 + miles
Score	4	3	2	1	0

24 How often has your child been out of the house by himself/herself **over the past week**?
(Please circle one of the following)

	0	1-7	8-13	14-20	21+
Score	*4*	*3*	*2*	*1*	*0*

25 Excluding trips to and from nursery school, how many times has your child been on a longer outing **over the past week**, which required some form of transport? (Please circle one of the following)

	0	1-3	4-7	8-10	11+
Score	*4*	*3*	*2*	*1*	*0*

26. What type of nursery school, is your child currently attending? (Please circle one of the following)

None
Pre-school (e.g. Nursery, Playgroup etc.)
Special Pre-school
Infant/Primary without Special Support Unit attached
Infant/Primary with Special Support Unit attached
Special School: Physical disability
Special School: Learning difficulties
Home teaching (Including Portage)
Other (please specify) .....

27 How often does your child attend school? (Please circle one of the following)

Part-time
Daily
Weekly boarding
Full boarding

Assign one score for questions 26 & 27 and take into account child's age as follows

Part time or daily	*Not school age, not at school*	
	Not school age, Pre-school (e.g. nursery, playgrounds	*0*
	School age, Infant/primary without special unit	
	School age, Infant primary with special unit	
	Not school age, Special pre school	*2*
	School age, Special school – physical disability	
	School age, Special school – learning difficulties	*2*
	School age, Home teaching: not at school	*3*
Boarding		*4*

28 Approximately how long does it take for your child to travel from home to school?
(Please circle one of the following)

	0-15mins	16-30 mins	31-45mins	46-1hr	1hr +
Score	*0*	*1*	*2*	*3*	*4*

29. How many friends has your child seen outside of school hours **over the past week**?
(Please circle one of the following)

	0	1-3	4-7	8-10	11+
Score	*4*	*3*	*2*	*1*	*0*

30. Do you have any family or friends locally to whom you can turn for help if necessary?
(Please circle one of the following)

	YES	**NO**
Score	*0*	*4*

31 Do you think that the people in your local area are generally supportive and understanding where your child is concerned? (Please circle one of the following)

	YES	**NO**	**SOMETIMES**
Score	*0*	*4*	*2*

32 Do you think that your child restricts your social life in any way? (Please circle one of the following)

	YES	**NO**	**SOMETIMES**
Score	*4*	*0*	*2*

33 Do you have any difficulties in organising family holidays because of your child? (Please circle one of the following)

	YES	**NO**
Score	*4*	*0*

34. How many other members of your child's family are living at the same residence as your child? Please state their relationship to your child.
If this question is left blank, assume the child is living with both natural parents.

Assign Score	*If the child is living with both natural parents*	–	*0*
	If the child is living with only one natural parent	–	*2*
	If child living with neither natural parent or in an institution	–	*4*

35. Please describe if any member of the family has had to change their employment situation to make caring for your child easier.
If this question is left blank, assume no changes have been made to family employment.

Assign Score	*No changes to family employment*	–	*0*
	Temporary/occasional interruption or difficulty to either parent	–	*2*
	Permanent change in employment situation for either parent	–	*4*

36. Do you think that your child has placed any extra stress on you as parents/carers?
(Please circle one of the following)

	NONE	SLIGHT	SEVERE
Score	*0*	*2*	*4*

37. Do you think that your child has placed any stress on any other children within the family?
(Please circle one of the following)

	NO OTHER CHILDREN	NONE	SLIGHT	SEVERE
Score	*0*	*0*	*2*	*4*

APPENDIX 3

SCORING PROCEDURE

Use the scored questionnaire with the Scoring Form to complete this procedure.

Create a **raw score** by summating the scores for the questions pertaining to each dimension as follows:

Physical independence	Questions	17(i),17(ii),17(iii),17(iv), 17(v),17(vi),17(vii), 17(viii),17(ix),18,19,20
Clinical burden	Questions	1,2,3,4,5,6,8,9,10,11,12
Mobility	Questions	17(x - xii), 21ACCESS 1, 21ACCESS 3,22,23,24,25
Economic burden	Questions	7,13,14,15,16,35
Social integration	Questions	29,30,31,32,33,34,36,37
Schooling	Questions	26&27,28

Convert this into a **dimensional score** out of 100, which is comparable between dimensions, by multiplying the raw score for each dimension by the appropriate dimension constant:

Physical independence	2.0834
Mobility	3.5714
Clinical burden	2.2728
Schooling	12.500
Economic burden	4.1667
Social integration	3.1250

Create the overall Lifestyle Assessment Score (LAS) by using the weighted additive model:

$$J = \beta_1 n_1 + \beta_2 n_2 + \beta_3 n_3 + \beta_4 n_4 + \beta_5 n_5 + \beta_6 n_6 + C,$$

where: J = LAS
β = weighting applied to each dimensional score
n = dimensional score
C = constant term = 4.05

by using the following weightings with each dimensional score:

Physical independence	0.357
Mobility	0.270
Clinical burden	0.033
Schooling	0.016
Economic burden	0.082
Social integration	0.224

Multiply each dimensional score by its weighting, to create a **weighted score**. Summate the weighted scores and the constant term C to arrive at the LAS.

SCORING FORM

Use this form in conjunction with each completed and scored questionnaire, and refer to the Scoring Procedure as described under Appendix 3 of the LAQ-CP Manual.

CHILD'S NAME: .....

Physical Independence
Raw Score = ... x 2.0834 = ... *(Dimensional Score)* x 0.357 = ... *(Weighted Score)*

Mobility
Raw Score = ... x 3.5714 = ... *(Dimensional Score)* x 0.270 = ... *(Weighted Score)*

Clinical Burden
Raw Score = ... x 2.2728 = ... *(Dimensional Score)* x 0.033 = ... *(Weighted Score)*

Schooling
Raw Score = ... x 12.500 = ... *(Dimensional Score)* x 0.016 = ... *(Weighted Score)*

Economic Burden
Raw Score = ... x 4.1667 = ... *(Dimensional Score)* x 0.082 = ... *(Weighted Score)*

Social Integration
Raw Score = ... x 3.1250 = ... *(Dimensional Score)* x 0.224 = ... *(Weighted Score)*

Sum of Weighted Scores = ...+ 4.05

= LAS ☐

Standardised descriptive profile of Dimensional Scores:

Physical	0	10	20	30	40	50	60	70	80	90	100
Mobility	0	10	20	30	40	50	60	70	80	90	100
Clinical	0	10	20	30	40	50	60	70	80	90	100
Schooling	0	10	20	30	40	50	60	70	80	90	100
Economic	0	10	20	30	40	50	60	70	80	90	100
Social Int.	0	10	20	30	40	50	60	70	80	90	100

ANNEXURE-VI-ETHICAL CLEARANCE LETTER

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http//www.jnmc.edu
E-Mail : domc@jnmc.edu
Phone: (+ 91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/\ 2. Date: 24/11/2018

To,

(REG NO.BM0118001)

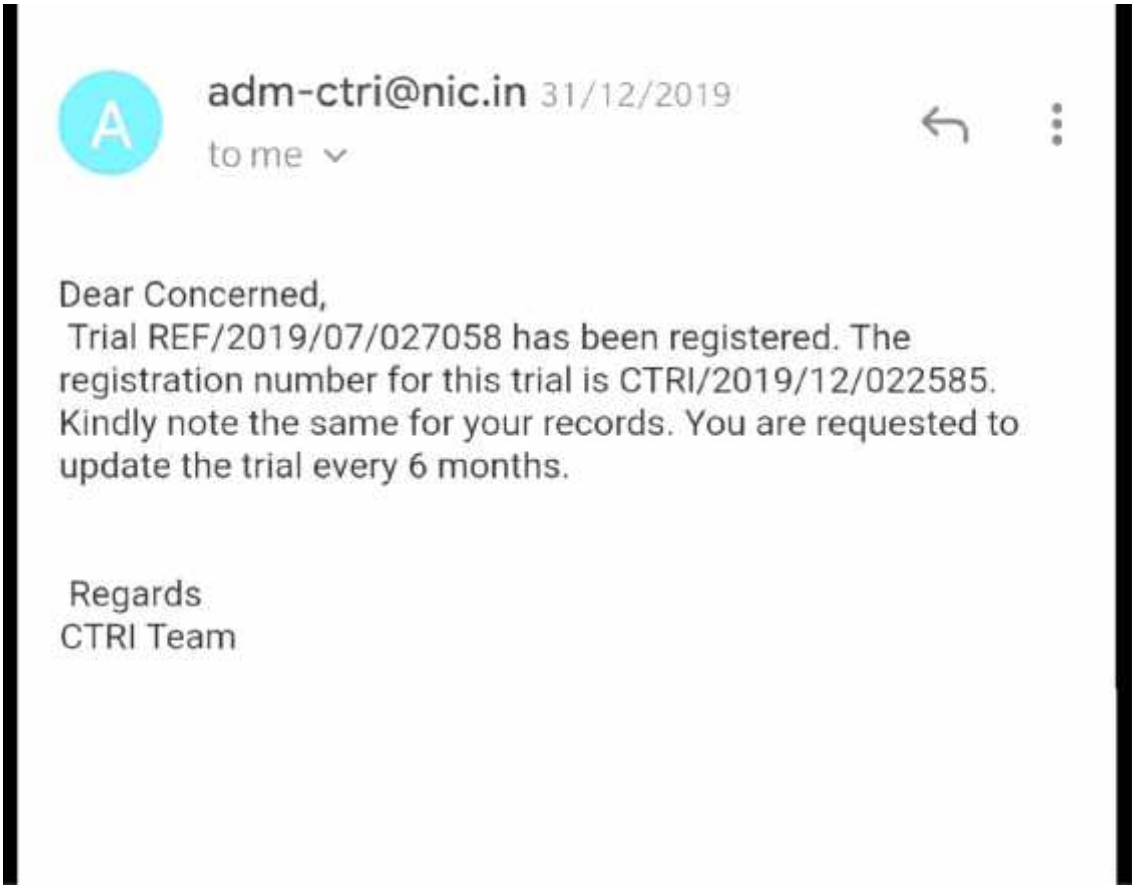
Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"COMPARATIVE STUDY OF CLINICAL EFFICACY OF TOLPERISONEVSBACLOFEN IN TREATING SPASTICITYIN CHILDREN WITH CEREBRAL PALSY : A 1 YEAR RANDOMIZED CONTROLLED TRIAL AT KLE DR PRABHAKAR KORE CHARITABLE HOSPITAL, BELGAUM"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

CTRI REGISTRATION FORM



adm-ctri@nic.in 31/12/2019

to me

Dear Concerned,
Trial REF/2019/07/027058 has been registered. The registration number for this trial is CTRI/2019/12/022585. Kindly note the same for your records. You are requested to update the trial every 6 months.

Regards
CTRI Team

ANNEXURES VII - MASTER CHART

Drug A - baclofen	Basic details: Name	Age	Gender	Presenting complaints: Developmental quotient: Gross motor	social	language	Neurological co morbidities: Behavioural changed	seizures	visual abnormality	hearing abnormality	Non neurological co morbidities: Drooling	Deformity	Dental caries	Vomitin/constipation	Family history: congsanity		Birth history: Birth order	ANC	Gestation	Place of delivery	Mode of Delivery	PROM	Multiple pregnancy	Cry at birth	Birth weight	Post natal: NICU stay	Diagnosis: Topographical	Physiological classification	GMFCS	Preintervention measures: MAS: Elbow	Wrist	Hamstrings	Quadriceps	Gastronemius	Soleus
1	Spoorthi	2years	2	1	1	1	1	1	2	2	1	1	1	2	2		1	1	2	1	2	1	2	1	2	1	1	1	3	1+	1+	1+	2	2	2
2	Samarth	8years	1	1	1	1	2	2	1	2	1	1	1	1	1		1	1	1	1	1	2	2	2	1	1	1	1	5	2	2	2	3	3	3
3	Nikitha	4years	2	1	1	1	2	2	2	2	2	1	2	2	1	3rd	3	1	1	1	1	2	2	2	1	1	1	1	3	2	2	2	3	3	3
4	Chethan	6 years	1	2	1	1	1	2	2	2	1	1	1	2	1		1	1	1	1	1	2	2	2	1	1	1	1	4	3	2	2	3	3	3
5	Anam	2.5years	2	1	1	1	1	1	2	2	1	1	2	1	1	3rd	1	1	1	1	1	2	2	1	1	2	2	2	5	3	3	3	3	3	3
6	Vikas siddappa	12 years	1	1	1	1	1	2	2	2	2	2	2	1	1	3rd	1	1	2	1	1	2	2	2	2	1	2	2	5	3	3	3	3	3	3
7	Vaishnavi	3 years	2	2	1	1	2	2	2	2	1	1	1	1	1	2nd	2	1	1	1	1	2	2	1	2	1	1	1	2	2	2	2	3	3	3
8	Shravan	2years	1	1	1	1	1	2	2	2	2	2	2	1	2		2	1	2	1	1	2	2	1	2	1	1	1	3	1+	1+	2	2	3	3
9	Bibi Fathima	1 year	2	1	1	1	2	2	1	2	1	1	2	1	1	2nd	1	1	1	1	1	2	2	2	2	1	2	2	2	1+	1+	1+	2	2	2
10	Rakshappa	4 years	1	1	1	1	1	1	2	2	1	2	1	2	2		1	1	1	1	1	2	2	1	2	1	1	2	4	2	2	2	2	3	3
11	jayas	2 years	1	1	2	2	1	2	2	2	1	1	2	1	2		1	1	1	1	1	2	2	1	1	2	1	1	3	1+	1+	1	2	2	2
12	Sukruth	8 years	1	1	1	1	1	1	2	2	2	1	1	2	1	2nd	1	1	2	1	1	2	2	1	2	1	1	1	2	1+	1+	2	2	2	2
13	Siddharth	3 years	1	1	1	2	2	2	2	2	2	2	1	2	2		2	1	1	1	1	2	2	2	1	1	1	2	3	1+	1+	1+	2	2	2
14	Bheemashankar	12 years	1	1	1	1	1	2	2	2	1	1	1	1	2		4	1	2	1	1	2	2	1	2	1	2	2	4	2	2	3	3	3	3
15	Samiha Amit	2 years	2	1	1	1	2	2	2	1	2	2	2	2	2		1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1+	1+	1+	1+
16	Gangavva	9 years	2	2	2	2	2	2	1	2	1	1	2	1	1	2nd	3	1	1	1	2	2	2	1	1	1	1	2	3	1+	1+	1+	2	2	2
17	Ramesh chougala	4 years	1	1	2	2	2	1	2	2	1	1	1	2	2		1	1	2	1	1	2	2	1	2	1	1	1	2	1+	1+	2	3	3	3
18	Anagha	4 years	2	1	2	2	2	2	2	1	1	2	1	1	2		2	1	1	1	1	2	2	2	1	1	1	2	3	2	2	2	2	2	2
19	Nataraj	5 years	1	1	1	1	1	2	2	2	2	2	2	1	2		1	1	2	1	1	2	2	1	1	1	1	1	3	2	2	2	2	2	2
20	Muskan	1.5 years	2	2	2	2	2	2	2	2	1	1	1	2	1	3rd	1	1	1	1	1	2	2	2	1	1	1	1	3	1+	1+	2	2	2	2
21	Ritesh Basappa	3 years	1	1	1	1	1	2	2	2	2	2	2	2	2		1	1	1	1	1	2	2	2	1	1	1	2	4	2	2	2	3	3	3
22	Jyothibha	4years	1	1	1	1	2	2	2	2	1	1	1	1	1	3rd	3	1	1	1	1	1	2	2	1	1	2	1	5	3	3	3	3	3	3
23	Gagankumar	1 year	1	2	1	1	2	2	2	1	2	2	2	2	2		1	1	1	1	2	2	2	2	1	2	1	1	5	1+	1+	2	2	2	2
24	Varsha	3 years	2	2	2	2	2	2	2	2	1	1	1	1	2		2	1	1	1	1	2	2	1	1	1	1	2	2	1+	1+	1+	2	2	2
25	Sreeja	2years	2	1	1	1	2	1	2	2	2	2	1	1	2		1	1	1	1	1	2	2	2	1	1	1	1	3	2	2	2	2	2	2
26	Revansidappa	2.5 years	1	1	2	2	2	2	2	2	2	2	2	2	1	2nd	2	1	1	1	1	2	2	1	1	2	1	1	3	2	2	2	2	2	2
27	Spandana	3.5 years	2	1	2	2	2	2	2	1	2	1	2	1	2		1	1	1	1	1	2	2	1	1	1	1	1	5	2	2	2	2	2	2
28	Kempegowda khot	4 years	1	1	1	1	1	1	2	2	1	1	2	1	2		2	1	1	1	1	2	2	1	1	1	1	2	3	2	2	2	2	2	2
29	Sathvik	2years	1	1	2	2	2	2	2	2	1	1	1	2	2		1	1	1	1	1	2	2	2	1	1	2	2	4	2	2	2	3	3	3
30	Soundarya	2 years	2	1	2	2	2	2	2	1	2	1	1	1	2		2	1	2	1	1	2	2	2	1	1	2	2	5	2	2	2	3	3	3

Drug A - baclofen	Name	Pre QUEST: Dissociated movements	Grasp	Weight bearing	Protective extension	QUEST Total	GMFM	CPQOL	Drug intervention	Post intervention measures: MAS: Elbow	Wrist	Hamstrings	Quadriceps	Gastronemius	Soleus	Dissociated mevements	Grasp	Weight bearing	Protective extension	QUEST Total	GMFM	CPQOL	Adverse effects: Costipation	Drowsiness	Weakness	Dry mouth	Diarrhea	Anorexia
1	Spoorthi	56.24	48.14	64	66.66	58.76	40.60%		1	1+	1+	1+	1+	1+	1+	56.24	48.14	64	66.66	58.76	40.60%	0	2	2	2	2	2	2
2	Samarth	36	22.22	60	70	47	59.2	69.36	1	2	2	2	3	3	3	36	22.22	60	70	47	61.4	69.36	1	2	2	2	2	2
3	Nikitha	65.62	37.02	72	83.32	64.49	54.34	40.39	1	2	2	2	2	2	2	87.5	70.3	86	83.32	81.78	68.02	58.19	2	2	2	2	1	2
4	Chethan	34	29	40	50	38.25	28	78	1	2	2	2	2	2	2	34	29	40	50	38.25	28	78	2	1	2	2	2	2
5	Anam	38	32	52	58	45	32	0	1	2	2	2	3	3	3	38	32	52	58	47.42	32	0	1	2	2	2	2	2
6	Vikas siddappa	28	30	20	20	24.5	29.16	80	1	2	2	3	3	3	3	28	30	20	20	24.5	28	76	2	2	2	2	2	1
7	Vaishnavi	66.1	28	26.4	16.6	34.2	53.74	0	1	2	2	2	2	3	3	72	40	53	30	48.75	64	0	1	2	2	2	2	2
8	Shravan	83.37	78.26	73.6	66.66	75.5	21.75	0	1	1+	1+	2	2	2	2	83.37	78.26	73.6	66.66	75.5	38.92	0	2	2	2	2	2	2
9	Bibi Fathima	0	0	0	0	0	15	0	1	1+	1+	1+	2	2	2	0	0	0	0	0	18	0	2	2	2	2	1	2
10	Rakshappa	36	32	44	55.56	41.89	26	0	1	2	2	2	2	3	3	36	32	44	55.56	41.89	26	0	2	2	2	2	2	2
11	jayas	56	38	62	72	57	70	0	1	1+	1+	1	2	2	2	56	38	72	70	59	70	0	2	2	1	2	2	2
12	Sukruth	72	40	72	85	67.25	66	78	1	1+	1+	2	2	2	2	72	40	72	85	67.25	66	78	2	2	2	2	2	2
13	Siddharth	68	70	70	80	72	58	0	1	1+	1+	1+	2	2	2	68	70	70	80	68	58	0	2	2	2	2	2	2
14	Bheemashankar	56	60	60	60	59	60	76	1	2	2	3	3	3	3	56	60	60	60	59	60	76	2	1	2	2	2	2
15	Samiha Amit	68	56	90	90	76	78	0	1	1	1	1+	1+	1+	1+	68	56	90	90	76	78	0	2	2	2	2	2	2
16	Gangavva	65	70	70	70	68.75	78.4	0	1	1+	1+	2	2	2	2	65	70	70	70	68.75	78.4	0	2	2	2	2	2	2
17	Ramesh chougala	70	68	80	80	74.5	75	38	1	1+	1+	2	3	3	3	70	68	80	80	74.5	75	38	2	2	2	2	2	2
18	Anagha	56	56	60	58	57.5	64.5	70.2	1	2	2	2	2	2	2	66	60	70	70	66.5	72	70.2	2	2	2	2	2	2
19	Nataraj	56	62	66	68	63	65	63	1	2	2	2	2	2	2	56	62	66	68	63	65	63	1	2	2	1	2	2
20	Muskan	66	56	70	68	65	56	0	1	1+	1+	2	2	2	2	66	56	70	68	65	56	0	2	2	2	2	2	2
21	Ritesh Basappa	60	58	50	62	57.5	62	0	1	2	2	2	3	3	3	60	58	50	62	57.5	62	0	2	2	2	2	2	2
22	Jyothibha	40	44	40	44	42	39.3	82	1	3	3	3	2	2	2	40	44	40	44	42	37.4	80.3	2	1	2	2	2	2
23	Gagankumar	0	0	0	0	0	20	0	1	1+	1+	2	2	2	2	0	0	0	0	0	20	0	2	2	2	2	1	2
24	Varsha	82	78	73	74	76.75	77	0	1	1+	1+	1+	2	2	2	82	78	73	74	76.75	77	0	2	2	2	2	2	2
25	Sreeja	62	66	60	56	61	73	0	1	2	2	2	2	2	2	62	66	60	56	61	73	0	2	2	1	2	2	2
26	Revansidappa	70	64	70	56	65	70	0	1	2	2	2	2	2	2	70	64	70	56	65	70	0	1	2	2	2	2	2
27	Spandana	38	20	15	0	18.25	18.51	0	1	2	2	2	2	2	2	38	20	15	0	18.25	22	0	2	2	2	2	2	2
28	Kempegowda khot	54	60	62	58	58.5	44.5	60	1	1+	1+	2	2	2	2	58	62	64	58	60.5	44.5	60	2	2	2	2	2	1
29	Sathvik	62.6	41	54	30.5	26.52	37.46	0	1	2	2	2	3	3	3	62.6	41	54	30.5	26.52	37.46	0	2	1	2	2	2	2
30	Soundarya	45.31	29.6	48	50	43.22	22.7	0	1	2	2	2	2	2	2	45.31	29.6	48	50	43.22	28	0	2	2	1	2	2	2

Drug B - tolperisone	Basic details: Name	Age	Gender	Presenting complaints: Developmental quotient: Gross motor	social	language	Neurological co morbidities: Behavioral abnormalities	Seizures	Visual abnormalities	hearing	Non neurological co morbidities: Drooling	Deformity	Dental caries	Vomiting/constipation	Family history: congsanity		Birth history: Birth order	ANC	Gestation	Place of delivery	Mode of Delivery	PROM	Multiple pregnancy	Cry at birth	Birth weight	Post natal: NICU stay	Diagnosis: Topographical	Physiological classification	GMFCS	Preintervention measures: MAS: Elbow	Wrist	Hamstrings	Quadriceps	Gastronemius	Soleus
1	Puneeth	5years	1	1	1	1	2	2	2	1	2	1	2	2	1	2nd	1	1	2	1	1	2	2	2	2	1	3	2	4	1+	1+	2	2	2	2
2	Shreya	2 years	2	1	1	1	1	1	2	2	1	1	1	1	1		3	1	2	1	1	2	2	1	2	1	1	1	3	2	2	2	2	2	2
3	Dundappa	18months	1	2	2	2	2	1	2	2	2	2	1	2	1	3rd	3	1	1	1	1	2	2	1	1	2	1	1	2	1+	1+	2	2	2	2
4	Tanish	17months	1	1	2	1	2	2	2	2	2	2	1	2	2		2	1	2	1	2	1	2	2	2	1	2	2	3	2	2	2	2	2	2
5	Ramlingappa	12 years	1	1	1	1	1	2	2	2	1	1	1	1	2		3	1	1	1	1	1	2	1	2	1	3	2	5	3	3	2	3	3	3
6	Lakkavva	7years	2	1	1	1	1	2	2	2	1	1	1	1	2		1	1	1	1	1	2	2	1	2	1	3	1	4	2	2	3	3	3	3
7	Sahil Hanji	2years	1	1	1	1	2	1	2	2	1	1	1	1	2		1	1	2	1	2	1	2	2	1	1	1	1	3	3	3	2	3	3	3
8	Vinayak shimshi	3.5 years	1	1	1	1	2	2	2	2	2	1	2	2	2		1	1	1	1	1	2	2	2	1	1	3	1	5	3	3	3	3	3	3
9	Inchara	6 years	1	1	2	1	1	2	2	2	1	1	1	2	2		1	1	1	1	1	1	2	1	1	1	1	2	3	2	2	2	3	3	3
10	Adarsh	9 years	1	1	1	2	1	2	2	2	1	1	1	1	2		2	1	1	1	1	2	2	2	1	1	3	2	4	2	2	2	2	2	2
11	Halalamma	7 years	2	1	2	2	2	1	2	2	2	2	2	2	2	2nd	1	1	1	1	1	2	2	1	2	1	1	2	2	1+	1+	2	2	2	2
12	Laxmi Angadi	2 yeasa	2	1	1	1	2	2	2	1	1	2	2	2	2		2	1	2	1	1	1	2	1	2	1	3	2	3	1+	1+	2	2	2	2
13	Samuel	1.5years	1	1	2	2	1	2	2	2	2	2	2	2	2		5	1	1	1	1	2	2	1	2	2	1	1	4	2	2	2	3	3	3
14	Prathika	1year	2	2	1	1	2	2	2	2	2	2	1	2	1	2nd	2	1	1	1	1	2	2	2	2	1	1	2	4	2	2	2	3	3	3
15	Tanushree	6 years	2	1	1	2	2	2	2	2	1	1	1	1	1	2nd	1	1	1	1	1	2	2	1	1	1	3	2	3	2	2	2	2	2	2
16	Sumit	8years	1	1	2	1	1	1	2	2	2	1	1	2	2		3	1	2	1	1	2	2	1	2	1	3	2	4	2	2	2	3	3	3
17	Anil Naik	2.5 years	1	1	2	2	2	2	2	2	2	2	2	2	2		5	1	2	1	1	1	2	1	2	1	1	1	2	1+	1+	1+	2	2	2
18	Sevanthi	7years	2	1	1	1	2	1	2	2	1	1	1	1	1	2nd	1	1	2	1	2	2	1	2	2	1	1	2	3	1+	1+	2	2	2	2
19	Rukmini	2 years	2	1	1	1	2	2	2	2	2	2	1	2	2		1	1	1	1	1	2	2	2	2	1	1	1	3	2	2	2	2	2	2
20	Prem naik	1.5 years	1	1	1	1	1	2	2	2	1	1	1	1	2		1	1	1	1	1	2	2	2	2	1	3	2	4	2	2	3	3	3	3
21	Rahul	5.5years	1	2	1	1	2	2	2	2	2	2	2	2	2		1	1	2	1	2	1	2	1	2	1	3	1	5	3	3	2	3	3	3
22	Saksham	2 years	2	1	1	1	2	2	2	2	1	1	1	1	1	2nd	2	1	2	1	1	2	2	2	2	1	1	2	3	1+	1+	1+	2	2	2
23	Shakambari	3 years	2	1	2	2	2	1	2	2	2	2	2	2	2		2	1	1	1	1	1	2	2	1	1	1	1	3	2	2	2	2	2	2
24	Shiyon	2 years	2	1	1	1	2	2	2	2	2	2	2	2	2		1	1	2	1	1	2	2	1	2	1	1	2	3	1+	1+	1=	2	2	2
25	Vijay	4years	1	2	1	1	1	1	2	2	1	1	1	1	1	3rd	4	1	1	1	1	2	2	2	1	1	3	1	4	2	2	2	3	3	3
26	Abbas	year 3 mont	1	2	1	1	2	2	2	2	2	2	1	2	1	3rd	1	1	1	1	1	2	2	1	1	1	3	1	4	2	2	2	2	2	2
27	Adivesh	1 year	1	2	1	1	2	2	2	2	2	2	2	2	1	2nd	3	1	1	1	1	2	2	2	1	1	3	2	5	2	2	2	3	3	3
28	Tayappa	3 years	1	1	2	2	2	2	2	2	1	1	1	2	2		1	1	1	1	1	2	2	1	1	1	1	1	3	2	2	2	3	3	3
29	Shreya	2.5years	2	2	2	1	2	2	2	2	1	1	1	1	2		1	1	1	1	1	1	2	1	2	1	1	1	3	1+	1+	2	3	3	3
30	Dayananda	3 years	1	2	1	1	2	2	2	2					2		2	1	1	1	1	1	2	2	2	1	1	2	4	2	2	2	2	3	3

Drug B - tolperisone	Name	Pre: QUEST: Dissociated movements	Grasp	Weight bearing	Protective extension	QUEST: Total	GMFM	CPQOL	Drug intervention	Post intervention measures: MAS: Elbow	Wrist	Hamsrings	Quadriceps	Gastronemius	Soleus	QUEST: Dissociated mevements	Grasp	Weight bearing	Protective extension	QUEST: Total	GMFM	CPQOL	Advesr effect: Constipation	Drowsiness	Weakness	Dry mouth	Diarrhea	Anorexia
1	Puneeth	32.8	29.62	42	55.56	39.99	40.42	65.07	2	1+	1+	2	1+	2	2	32.8	29.62	42	55.56	39.99	40.42	65.07	1	2	2	2	2	2
2	Shreya	85.94	55.56	81.56	100	80.76	57.6	0	2	1+	1+	1+	1+	1+	1+	85.94	55.56	81.6	100	80.76	58.9	0	1	2	2	2	2	2
3	Dundappa	67.18	25.92	58	72	55.77	38.6	0	2	1+	1+	1+	1+	1+	1+	67.18	25.92	76.9	86.11	64.03	46.26	0	2	1	2	2	2	2
4	Tanish	31.6	22.22	53.84	66.66	43.58	34	0	2	2	2	2	2	2	2	36	22.22	58	66.66	45.72	49.78	0	2	1	2	2	2	2
5	Ramlingappa	22	28	20	20	22.5	15	72.5	2	2	2	2	2	2	2	28	30	22	20	26	22	72.5	1	2	1	2	2	2
6	Lakkavva	68.2	22.2	18	41.8	37.55	36	66	2	2	2	2	2	2	2	68.75	40.7	90	91.6	72.7	48.2	60	2	1	2	2	2	2
7	Sahil Hanji	65.62	34	70	83	63.15	56	0	2	3	3	2	3	3	3	65.62	34	70	83	63.15	56	0	1	2	2	2	2	2
8	Vinayak shimshi	40	29.6	42	55.5	41.77	34	0	2	2	2	2	2	2	2	70	28	42	56	44	42	0	1	2	2	2	2	2
9	Inchara	44	34	48	60	46.5	56	0	2	2	2	2	2	2	2	44	34	48	60	48	56	0	2	2	1	2	2	2
10	Adarsh	42	32	50	60	46	38.2	72.2	2	1+	1+	2	2	2	2	44	32	52	62	47.5	40	72.2	2	1	2	2	2	2
11	Halalamma	70	42	70	83	66,25	68	40	2	1+	1+	2	1+	1+	1+	76	48	76	83	70.75	72	40	1	2	2	2	2	2
12	Laxmi Angadi	40	26	62	72	50	60	0	2	1+	1+	2	2	2	2	40	26	62	72	52	60	0	2	2	1	2	2	2
13	Samuel	93.5	70.36	100	100	90.96	36.14	0	2	2	2	2	2	2	2	93.5	70.36	100	100	90.96	50.9	0	1	2	2	2	2	2
14	Prathika	0	0	0	0	0	28.42	0	2	2	2	2	2	2	2	0	0	0	0	0	.28.42	0	2	2	1	2	2	2
15	Tanushree	70	66	100	80	84.48	89	46.03	2	2	2	2	2	2	2	76	70	100	90	84	88.7	46.03	2	1	2	2	2	2
16	Sumit	60	58	58	62	59.5	55.42	62.93	2	1+	1+	2	2	2	2	66	68	70	70	68.5	61.3	62.93	1	2	2	2	2	2
17	Anil Naik	70	60	72	70	68	73	0	2	1+	1+	1+	2	2	2	70	60	72	70	68	73	0	2	2	2	1	2	2
18	Sevanthi	81.25	36	26	54	49.31	35.8	58.73	2	1+	1+	2	2	2	2	90.6	48.1	74	50	65.6	41.24	58.73	2	2	1	2	2	2
19	Rukmini	56	60	58	56	57.5	58	0	2	2	2	2	2	2	2	60	66	56	56	59.5	60	0	1	1	2	2	2	2
20	Prem naik	0	0	0	0	0	10	0	2	2	2	2	2	2	2	0	0	0	0	0	20	0	2	2	1	2	2	2
21	Rahul	38	44	40	38	40	36	70.22	2	2	2	2	2	2	2	50	52	60	60	55.5	48	70.22	2	1	2	2	2	2
22	Saksham	76.56	48.14	64	50	59.6	31.85	0	2	1+	1+	1+	1+	1+	1+	76.56	48.14	70	60	63.6	31.85	0	1	2	2	2	2	2
23	Shakambari	20	20	18	16	18.5	2.63	0	2	2	2	2	2	2	2	20	20	18	16	18.5	6	0	2	2	2	1	2	2
24	Shiyon	85.94	66.67	44	100	74.15	66.74	0	2	1+	1+	1+	2	2	2	84.94	70	55	100	77.7	72	0	1	2	2	2	2	2
25	Vijay	32	36	38	38	36	46.6	43	2	2	2	2	3	3	3	34	40	56	46	44	54	50	2	1	2	2	2	2
26	Abbas	0	0	0	0	0	13.64	0	2	1+	1+	2	2	2	2	0	0	0	0	0	17.2	0	2	2	2	2	1	2
27	Adivesh	0	0	0	0	0	2.5	0	2	1+	1+	1+	2	2	2	0	0	0	0	0	2.5	0	1	2	2	2	2	2
28	Tayappa	60	68	64	70	65.5	58	0	2	2	2	2	2	2	2	62	70	68	72	68	60	0	2	2	2	2	2	1
29	Shreya	68	70	72	70	70	52.5	0	2	1+	1+	2	2	2	2	68	70	72	70	70	60	0	1	1	2	2	2	2
30	Dayananda	64	62.9	48	50	56.22	32	0	2	1+	1+	2	2	2	2	64	62.9	48	62	59.22	38	0	2					

Drug B - tolperisone	Basic details			Presenting complaints			Neurological co morbiditied				Non neurological co morbiditie					Family history		Birth history							Post natal	Diagnosis		Preintervention measures															Drug intervention	Post intervention measures																	
	Name	Age	Gender	Developmental quotient			Behavioral abnormalities	Seizures	Visual abnormalities	hearing	Drooling	Deformity	Dental caries	Vomiting/constipation	congsanity		Birth order	ANC	Gestation	Place of delivery	Mode of Delivery	PROM	Multiple pregnancy	Cry at birth	Birth weight	NICU stay	Topographical	Physiological classification	GMFCS	MAS							QUEST				QUEST	GMFM	CPQOL		MAS							QUEST				QUEST	GMFM	CPQOL	Adverse effect	
				Gross motor	social	language																							Elbow	Wrist	Hamstrings	Quadriceps	Gastronemius	Soleus	Dissociated movements	Grasp	Weight bearing	Protective extension	Total			Elbow	Wrist	Hamsrings	Quadriceps	Gastronemius	Soleus	Dissociated mevements	Grasp	Weight bearing	Protective extension	Total			Constipation	Drowsiness
1	Puneeth	5years	1	1	1	1	2	2	2	1	2	1	2	2	1	2nd	1	1	2	1	1	2	2	2	2	1	3	2	4	1+	1+	2	2	2	2	32.8	29.62	42	55.56	39.99	40.42	65.07	2	1+	1+	2	1+	2	2	32.8	29.62	42	55.56	39.99	40.42	65.07	1	2
2	Shreya	2 years	2	1	1	1	1	1	2	2	1	1	1	1	1		3	1	2	1	1	2	2	1	2	1	1	1	3	2	2	2	2	2	2	85.94	55.56	81.56	100	80.76	57.6	0	2	1+	1+	1+	1+	1+	1+	85.94	55.56	81.56	100	80.76	58.9	0	1	2
3	Dundappa	18months	1	2	2	2	2	1	2	2	2	2	1	2	1	3rd	3	1	1	1	1	2	2	1	2	1	1	2	1+	1+	2	2	2	2	67.18	25.92	58	72	55.77	38.6	0	2	1+	1+	1+	1+	1+	1+	67.18	25.92	76.92	86.11	64.03	46.26	0	2	1
4	Tanish	17months	1	1	2	1	2	2	2	2	2	2	1	2	2		2	1	2	1	2	1	2	2	2	1	2	2	3	2	2	2	2	2	2	31.6	22.22	53.84	66.66	43.58	34	0	2	2	2	2	2	2	2	36	22.22	58	66.66	45.72	49.78	0	2	1
5	Ramlingappa	12 years	1	1	1	1	1	2	2	2	1	1	1	1	2		3	1	1	1	1	1	2	1	2	1	3	2	5	3	3	2	3	3	3	22	28	20	20	22.5	15	72.5	2	2	2	2	2	2	2	28	30	22	20	26	22	72.5	1	2
6	Lakkavva	7years	2	1	1	1	1	2	2	2	1	1	1	1	2		1	1	1	1	1	2	2	1	2	1	3	1	4	2	2	3	3	3	3	68.2	22.2	18	41.8	37.55	36	66	2	2	2	2	2	2	2	68.75	40.7	90	91.6	72.7	48.2	60	2	1
7	Sahil Hanji	2years	1	1	1	1	2	1	2	2	1	1	1	1	2		1	1	2	1	2	1	2	2	1	1	1	1	3	3	3	2	3	3	3	65.62	34	70	83	63.15	56	0	2	3	3	2	3	3	3	65.62	34	70	83	63.15	56	0	1	2
8	Vinayak shimshi	3.5 years	1	1	1	1	2	2	2	2	2	1	2	2	2		1	1	1	1	1	2	2	2	1	1	3	1	5	3	3	3	3	3	3	40	29.6	42	55.5	41.77	34	0	2	2	2	2	2	2	2	70	28	42	56	44	42	0	1	2
9	Inchara	6 years	1	1	2	1	1	2	2	2	1	1	1	2	2		1	1	1	1	1	1	2	1	1	1	1	2	3	2	2	2	3	3	3	44	34	48	60	46.5	56	0	2	2	2	2	2	2	2	44	34	48	60	48	56	0	2	2
10	Adarsh	9 years	1	1	1	2	1	2	2	2	1	1	1	1	2		2	1	1	1	1	2	2	2	1	1	3	2	4	2	2	2	2	2	2	42	32	50	60	46	38.2	72.2	2	1+	1+	2	2	2	2	44	32	52	62	47.5	40	72.2	2	1
11	Halalamma	7 years	2	1	2	2	2	1	2	2	2	2	2	2	2	2nd	1	1	1	1	1	2	2	1	2	1	1	2	2	1+	1+	2	2	2	2	70	42	70	83	66,25	68	40	2	1+	1+	2	1+	1+	1+	76	48	76	83	70.75	72	40	1	2
12	Laxmi Angadi	2 yeasa	2	1	1	1	2	2	2	1	1	2	2	2	2		2	1	2	1	1	1	2	1	2	1	3	2	3	1+	1+	2	2	2	2	40	26	62	72	50	60	0	2	1+	1+	2	2	2	2	40	26	62	72	52	60	0	2	2
13	Samuel	1.5years	1	1	2	2	1	2	2	2	2	2	2	2	2		5	1	1	1	1	2	2	1	2	2	1	1	4	2	2	2	3	3	3	93.5	70.36	100	100	90.96	36.14	0	2	2	2	2	2	2	2	93.5	70.36	100	100	90.96	50.9	0	1	2
14	Prathika	1year	2	2	1	1	2	2	2	2	2	2	1	2	1	2nd	2	1	1	1	1	2	2	2	2	1	1	2	4	2	2	2	3	3	3	0	0	0	0	0	28.42	0	2	2	2	2	2	2	0	0	0	0	0	28.42	0	2	2
15	Tanushree	6 years	2	1	1	2	2	2	2	2	1	1	1	1	1	2nd	1	1	1	1	1	2	2	1	1	1	3	2	3	2	2	2	2	2	2	70	66	100	80	84.48	89	46.03	2	2	2	2	2	2	2	76	70	100	90	84	88.7	46.03	2	1
16	Sumit	8years	1	1	2	1	1	1	2	2	2	1	1	2	2		3	1	2	1	1	2	2	1	2	1	3	2	4	2	2	2	3	3	3	60	58	58	62	59.5	55.42	62.93	2	1+	1+	2	2	2	2	66	68	70	70	68.5	61.3	62.93	1	2
17	Anil Naik	2.5 years	1	1	2	2	2	2	2	2	2	2	2	2	2		5	1	2	1	1	1	2	1	2	1	1	1	2	1+	1+	1+	2	2	2	70	60	72	70	68	73	0	2	1+	1+	1+	2	2	2	70	60	72	70	68	73	0	2	2
18	Sevanthi	7years	2	1	1	1	2	1	2	2	1	1	1	1	1	2nd	1	1	2	1	2	2	1	2	2	1	1	2	3	1+	1+	2	2	2	2	81.25	36	26	54	49.31	35.8	58.73	2	1+	1+	2	2	2	2	90.6	48.1	74	50	65.6	41.24	58.73	2	2
19	Rukmini	2 years	2	1	1	1	2	2	2	2	2	2	1	2	2		1	1	1	1	1	2	2	2	2	1	1	1	3	2	2	2	3	2	2	56	60	58	56	57.5	58	0	2	2	2	2	2	2	2	60	66	56	56	59.5	60	0	1	1
20	Prem naik	1.5 years	1	1	1	1	1	2	2	2	1	1	1	1	2		1	1	1	1	1	2	2	2	2	1	3	2	4	2	2	2	3	3	3	0	0	0	0	0	10	0	2	2	2	2	2	2	2	0	0	0	0	0	20	0	2	2
21	Rahul	5.5years	1	2	1	1	2	2	2	2	2	2	2	2	2		1	1	2	1	2	1	2	1	2	1	3	1	5	3	3	2	3	3	3	38	44	40	38	40	36	70.22	2	2	2	2	2	2	2	50	52	60	60	55.5	48	70.22	2	1
22	Saksham	2 years	2	1	1	1	2	2	2	2	1	1	1	1	1	2nd	2	1	2	1	1	2	2	2	2	1	1	2	3	1+	1+	1+	2	2	2	76.56	48.14	64	50	59.6	31.85	0	2	1+	1+	1+	1+	1+	1+	76.56	48.14	70	60	63.6	31.85	0	1	2
23	Shakambari	3 years	2	1	2	2	2	1	2	2	2	2	2	2	2		2	1	1	1	1	1	2	2	1	1	1	1	3	2	2	2	2	2	2	20	20	18	16	18.5	2.63	0	2	2	2	2	2	2	2	20	20	18	16	18.5	6	0	2	2
24	Shiyon	2 years	2	1	1	1	2	2	2	2	2	2	2	2	2		1	1	2	1	1	2	2	1	2	1	1	2	3	1+	1+	1=	2	2	2	85.94	66.67	44	100	74.15	66.74	0	2	1+	1+	1+	2	2	2	84.94	70	55	100	77.7	72	0	1	2
25	Vijay	4years	1	2	1	1	1	2	2	1	1	1	1	1	1	3rd	4	1	1	1	1	2	2	2	1	1	3	1	4	2	2	2	3	3	3	32	36	38	38	36	46.6	43	2	2	2	2	3	3	3	34	40	56	46	44	54	50	2	1
26	Abbas	1year 3 months	1	2	1	1	2	2	2	2	2	2	1	2	1	3rd	1	1	1	1	1	2	2	2	1	1	3	1	4	2	2	2	2	2	2	0	0	0	0	0	13.64	0	2	1+	1+	2	2	2	2	0	0	0	0	0	17.2	0	2	2
27	Adivesh	1 year	1	2	1	1	2	2	2	2	2	2	2	2	1	2nd	3	1	1	1	1	2	2	2	1	1	3	2	5	2	2	2	3	3	3	0	0	0	0	0	2.5	0	2	1+	1+	1+	2	2	2	0	0	0	0	0	2.5	0	1	2
28	Tayappa	3 years	1	1	2	2	2	2	2	2	1	1	1	2	2		1	1	1	1	1	2	2	1	1	1	1	1	3	2	2	2	3	3	3	60	68	64	70	65.5	58	0	2	2	2	2	2	2	2	62	70	68	72	68	60	0	2	2
29	Shreya	2.5years	2	2	1	2	2	2	2	2	1	1	1	1	2		1	1	1	1	1	2	1	1	2	1	1	1	3	1+	1+	2	3	3	3	68	70	72	70	70	52.5	0	2	1+	1+	2	2	2	2	68	70	72	70	70	60	0	1	1
30	Dayananda	3 years	1	2	1	1	2	2	2	2					2		2	1	1	1	1	1	2	2	2	1	1	2	4	2	2	2	2	3	3	64	62.9	48	50	56.22	32	0	2	1+	1+	2	2	2	2	64	62.9	48	62	59.22	38	0	2	

Weakness	Dry mouth	Diarrhea	Anorexia
2	2	2	2
2	2	2	2
2	2	2	2
2	2	2	2
1	2	2	2
2	2	2	2
2	2	2	2
2	2	2	2
1	2	2	2
2	2	2	2
2	2	2	2
1	2	2	2
2	2	2	2
1	2	2	2
2	2	2	2
2	2	2	2
2	1	2	2
1	2	2	2
2	2	2	2
1	2	2	2
2	2	2	2
2	2	2	2
2	1	2	2
2	2	2	2
2	2	2	2
2	2	1	2
2	2	2	2
2	2	2	1
2	2	2	2

ANNEXURE-VIII

KEY TO MASTER CHART

- GENDER: MALE – 1
  FEMALE – 2

- DEVELOPMENTAL QUOTIENT: <70% - 1
  >70% - 2

- CO- MORBIDITIES: YES – 1
  NO – 2

- CONSANGUINITY: YES -1
  NO – 2

- BIRTH ORDER: 1-1
  2-2
  3-3
  4-4

- ANC: YES – 1
  NO – 2

- GESTATION: TERM – 1
  PRETERM – 2

- PLACE OF DELIVERY: HOSPITAL – 1
  HOME – 2

- MODE OF DELIVERY: NVD – 1
  LSCS – 2

- PROM: YES -1
  NO – 2

- MULTIPLE PREGNANCY: YES – 1
  NO – 2

- CRY AT BIRTH: NORMAL – 1
  DELAYED – 2

- BIRTH WEIGHT: AGA - 1
  SGA - 2

- NICU STAY: YES -1
  NO – 2

- TOPOGRAPHICAL CLASSIFICATION:
  DIPLEGIC – 1
  HEMIPLEGIC – 2
  QUADRIPLEGIC – 3

- PHYSIOLOGICAL CLASSIFICATION:
  SPASTIC – 1
  MIXED – 2

- GMFCS CLASS: CLASS I – 1
  CLASS II – 2
  CLASS III – 3
  CLASS IV – 4
  CLASS V – 5

- MAS: 0 TO 3(0,1,1+,2,3,4)
- QUEST: 0 – 100%
- GMFM: 0 – 100%.
- CPQOL: 0 -100%.
- ADVERSE EFFECTS: YES -1, NO - 2