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INCREASED FREQUENCY OF URINARY TRACT INFECTIONS IS SEEN IN CHILDREN WITH CEREBRAL PALSY

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Abstract:
Introduction: *Cerebral palsy is a common cause of childhood morbidity. This morbidity comprised seizure disorders, mental retardation, abnormalities of vision, problems with respiratory muscle, and lower urinary tract dysfunctions. The lower urinary tract dysfunctions are manifested symptomatically as urinary incontinence, urgency, frequency, hesitancy, and urinary tract infection.*
Objective: *The objective of my study was to determine frequency of urinary tract infections (UTI) in children with cerebral palsy presented to department of Paediatric, General Hospital, Lahore.*
Study design: *It was a cross sectional study.*
Materials and Methods: *The study was conducted in department of Paediatric Lahore General Hospital, Lahore. The study was completed in the duration of 6 months from June 2016 to December 2016. A total of 115 patients fulfilling the inclusion criteria were taken from the Pediatric department of Lahore General Hospital, Lahore. After taking a written informed consent from the parents or attendants their basic demographic information like name, age and sex was obtained. For final diagnosis of UTI (as per operational definition) urine sample for complete urinalysis and culture/ sensitivity was taken in aseptic measures and then was sent to hospital laboratory. All data was collected by me on Performa (attached). All collected data was entered in SPSS version 20 and was analyzed by same software.*
Results: *The mean age of patients was 8±3.7 years with minimum and maximum age of 2 and 14 years. There were 76(66.09%) male and 39(33.91%) female cases with male to female ratio of 1.94:1. According to operational definition frequency of UTI was seen in 68(59.13%) of the cases.*
Conclusion: *Hence, our study found higher frequency of UTI in children with cerebral palsy. This problem may get worse with restricted mobility. Therefore, special efforts should be made for improving quality of life of patients by physiotherapy and effective treatment.*
Keywords: *cerebral palsy, infection, urinary tract, complications*

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INTRODUCTION:

Cerebral palsy (CP) is the most common physical disability of childhood that describes a group of disorders of movement and posture that are also often accompanied by associated impairments and secondary musculoskeletal problems [1,2]. CP is classified based on predominant neurological symptoms, and is divided into spastic, dyskinetic and ataxic types. Spastic CP accounts for 80% of all CP cases and is divided according to the distribution of symptoms, into hemiplegia, diplegia and tetraplegia [3]. The prevalence of CP is approximately 2 in 1000 live births [4]. The causes of CP are complex and largely unknown. Several predisposing factors and causal pathways have been suggested [3,5]. Most common are Preterm births, intrauterine growth restriction, perinatal infections, and multiparity, present the largest risks for a cerebral palsy outcome.[5] There are various complications associated with children having cerebral palsy, in which the most common are epilepsy, symptomatic neurogenic bladder (SNB), pneumonia, malabsorption and gastrointestinal (GI) problems along with dehydration, psychiatric problems and urinary tract infection (UTI) [6,7]. Being focused on UTI in CP children I have found only one such study that has reported UTI in 20 (38.5%) CP children [8].

The rationale of my study is to determine frequency of UTI in CP children of our population as no local study is available and international data is quite deficient in this regard. I found only one study in literature which was done in Nigeria, showing higher frequency of UTI in CP child. Generally, we overlook such important complication in these children and this study will help me to find frequency of UTI in CP children in our population. This study will also help me to update our routine diagnosis and hence treatment plans for such patients as this neglected complication may lead to another severe health related issues in these children that is acute and chronic renal failure.

LITERATURE REVIEW

HISTORICAL PERSPECTIVE OF CEREBRAL PALSY

The first description of cerebral palsy as a clinical entity is attributed to William John Little, an eminent British orthopedic surgeon. In 1861, he wrote a monograph in which he proposed for the first time an association between perinatal asphyxia and poor neurological outcomes later in life [9]. Three decades later, Sigmund Freud, a neurologist and founder of psychoanalysis, questioned Little's conclusions on the cause of cerebral palsy. On the basis of the observation that children with cerebral palsy had medical comorbidities, including intellectual disability, epilepsy, and visual disturbances, he proposed that cerebral palsy could begin earlier in life, during in-utero brain development [10]. Despite Freud's hypothesis, the notion that complications during labour and delivery are the leading cause of cerebral palsy was widely accepted by the medical, scientific, and lay communities. Not until almost one century later did large population-based studies show that only a minority of cerebral palsy cases result from birth asphyxia, thus providing support for Freud's hypothesis[11].

Cerebral palsy is a clinical descriptive term applied to a heterogeneous group of neurodevelopmental disorders in which motor impairments often co-occur with a range of medical disorders. In 2004, the International Working Group on the Definition and Classification of Cerebral Palsy defined cerebral palsy as "a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain [12]. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour; by epilepsy, and by secondary musculoskeletal problems" [12]. Unfortunately, in some cases, once a child is given a clinical diagnosis of cerebral palsy, limited efforts, if any, are made to determine the underlying cause. However, identification of specific causes of the disorder would provide individuals with cerebral palsy and their families with numerous benefits, including a better understanding of the disorder, accurate assessment of recurrence risk, and early intervention; it would also encourage further research into the development of specific medical treatments and therapeutic interventions for cerebral palsy.

EPIDEMIOLOGY AND CLASSIFICATION OF CEREBRAL PALSY

Cerebral palsy is the most common cause of physical disability in childhood. The worldwide prevalence of cerebral palsy has remained stable at 2–3 per 1000 livebirths for more than four decades, despite substantial improvements in obstetric and neonatal care [13].. A recent report from the Centers for Disease Control and Prevention noted a prevalence of 3·3 per 1000 8-year-old children from four areas of the USA. Moreover, up to an estimated 1 million children and adults in the USA live with a diagnosis of cerebral palsy [14]. Because of the increasing life expectancy of individuals with cerebral palsy, the number of adults with this disorder is increasing and

their medical and social care needs are changing [14]. Cerebral palsy can be classified on the basis of four major components: type and severity of the motor abnormalities, anatomical distribution, associated impairments, and timing of the presumed causal event (prenatal, perinatal, or postnatal) [15]. A thorough physical and neurological examination can help to identify abnormal neuromuscular tone (hypotonia or hypertonia) and the predominant type of motor impairment, which can be spastic, ataxic, dyskinetic (dystonia or choreoathetosis), or mixed. The characteristics and severity of the motor impairments should be described for each limb and the trunk to diff erentiate unilateral from bilateral involvement and to establish an anatomical distribution (monoplegia, diplegia, triplegia, hemiplegia, and tetraplegia) [16]. These classification systems, which are based on motor type and topography, are often used to infer which area of the brain might be affected (pyramidal or extrapyramidal systems); however, they have poor reliability, even among experienced clinicians [17].

CAUSES OF CEREBRAL PALSY

The causes of cerebral palsy have been attributed to a wide range of prenatal, perinatal, and postnatal factors that can present as single, isolated factors or as a combination of multiple potential risk factors. The presence and contribution of individual events varies to some extent between gestational groups and cerebral palsy subtypes [26]. The most commonly reported risk factors include prematurity, low birthweight, birth asphyxia, fetal intrauterine exposure to maternal infection and inflammation, maternal fever during labour, multiple gestations, coagulation disorders and ischaemic stroke in the fetus or newborn, maternal thyroid disease, and placental pathology [27]. However, despite the large number of known and proposed causes, the specific causal mechanism remains elusive in most cases of cerebral palsy. Perhaps the most studied, and still controversial, risk factor associated with cerebral palsy is birth asphyxia. Historically, and unfortunately still today in many groups (eg, researchers, clinicians, and the general public), inadequate oxygen delivery to the brain, caused by adverse intrapartum events, is assumed to be the leading cause of cerebral palsy [28].

On the basis of this hypothesis, detection and early intervention in episodes of acute birth asphyxia were proposed as ways to decrease the rate of cerebral palsy and improve long-term neurological outcomes of newborns at risk. To that extent, technologies such as electronic fetal monitoring during birth were developed and rapidly introduced into clinical practice, without adequate supporting evidence from scientific studies [29]. Electronic fetal monitoring, considered a standard of care by many physicians and institutions, is now widely used to detect early fetal distress resulting from hypoxia during delivery, and despite a five-times increase in the rate of caesarean sections, driven partly by the use of electronic fetal monitoring, the incidence of cerebral palsy has not decreased over time [30].

EVIDENCE FOR GENETIC FACTORS IN CEREBRAL PALSY

Several lines of evidence support the theory that multiple genetic factors contribute to the cause of cerebral palsy. First, mutations in multiple genes result in mendelian disorders that present with cerebral palsy-like features, and several single-gene mutations have been identified in idiopathic (ie, non-syndromic) cerebral palsy pedigrees [40]. Second, the prevalence of congenital anomalies in individuals with cerebral palsy (11–32%) is significantly higher than in the general population (2–3%) [41,42]. Most malformations in children with cerebral palsy are cerebral (72%), of which microcephaly (26%) and hydrocephaly (19%) are the most common [41]. Among the non-cerebral malformations, the most frequent are cardiac (29%), musculoskeletal (14%), and urinary abnormalities (9%), and facial clefts (18%) [41,43,44].

Third, register-based studies have reported a significantly higher concordance rate for cerebral palsy in monozygotic twins than in dizygotic twin pairs (p=0·0026) [45].

Fourth, the risk of cerebral palsy in consanguineous families is about 2·5 times higher than the risk in outbred families [46]. Fifth, several studies have reported familial aggregation of cerebral palsy, including identical cerebral palsy syndromes in the same family [47]. Sixth, a paternal age effect has been described in some forms of cerebral palsy [48]. Furthermore, a quantitative analysis of risk factors in 681 individuals with congenital cerebral palsy, from the west Swedish population-based cerebral palsy study, estimated that 60% of hemiplegic cerebral palsy cases, 45% of spastic diplegic cases, and an estimated 100% of cases with isolated ataxia, were caused by genetic mutations [49]. The mathematical method used for this study, which was based on medical history analysis of prenatal and perinatal risk factors, has been previously validated and successfully applied for the study of individuals with intellectual disabilities. Despite the growing body of evidence for genomic causes of cerebral palsy, it has

traditionally been proposed that genetic and metabolic abnormalities should be ruled out before a diagnosis of cerebral palsy is made [50].

THE CEREBRAL PALSY SPECTRUM DISORDERS

Cerebral palsy is a non-specific clinical diagnosis made on the basis of the presence of signs and symptoms, such as delayed motor development and abnormalities in posture, muscle tone, coordination, and reflexes. Thus, it is not uncommon for individuals with a wide range of neurodevelopmental conditions to be diagnosed with cerebral palsy[52]. Several single-gene (mendelian) disorders, inherited as autosomal dominant, autosomal recessive, or X-linked, often present with clinical features similar to cerebral palsy (webappendix). In such cases, individuals might live with a diagnosis of cerebral palsy for several years before specific molecular or biochemical diagnostic testing is done. Some of these mendelian disorders are individually rare, but as a group they are not uncommon and should all be considered when assessing an individual with cerebral palsy. Moreover, the spectrum of cerebral palsy-like syndromes includes some genetic conditions that, once identified, can be successfully treated with available drugs. Of particular interest, because of the potential for gnomically guided therapeutic interventions, is the group of dopa-responsive dystonic disorders caused by mutations in the GCH1 (GTP cyclohydrolase 1), SPR (sepiapterin reductase), and TH (tyrosine hydroxylase) genes [53].

If untreated, individuals with these disorders can progress to a state of complete loss of ambulation, whereas appropriate management with levodopa results in a dramatic and sustained improvement in symptoms, even in advanced cases [54]. Recently, Lee and colleagues reported the case of a severely disabled young woman who presented with bilateral club foot, stiff ness of the trunk, neck, and arms, and an inability to walk. She had lived with a diagnosis of cerebral palsy for more than 10 years until a small dose of levodopa was prescribed and dramatically improved her condition, prompting further genetic testing [55]. Sequencing of the GCH1 gene identified a pathogenic mutation and a diagnosis of dopa-responsive dystonia was made. Because of shared clinical features, up to 24% of patients with dopa-responsive dystonia are initially diagnosed with cerebral palsy [56].

DIAGNOSIS OF CEREBRAL PALSY

Observation of slow motor development, abnormal muscle tone, and unusual posture are common initial clues to the diagnosis of cerebral palsy. Assessment of persistent infantile reflexes is important. In infants who do not have cerebral palsy, the Moro reflex is rarely present after six months of age, and hand preference rarely develops earlier than 12 months of age. Hand preference may occur before 12 months of age if spastic hemiplegia is present [39]. Progressive hereditary neurologic or metabolic disorders must be eliminated as the cause of observed abnormalities. The testing strategy is based on the clinical picture, pattern of development of symptoms, family history, and other factors influencing the probability of specific diagnoses. Targeted laboratory tests and cerebral imaging using computed tomography, magnetic resonance imaging, and ultrasound are useful physical diagnostic tools. Surveillance for associated disabilities such as hearing and vision impairment, seizures, perception problems with touch or pain, and cognitive dysfunction can help complete the clinical assessment and determine the diagnosis [39].

CLINICAL FEATURES OF CEREBRAL PALSY

Seventy to 80 percent of patients with cerebral palsy have spastic clinical features. Affected limbs may demonstrate increased deep tendon reflexes, tremors, muscular hypertonicity, weakness, and a characteristic scissors gait with toe-walking [63]. The athetoid or dyskinetic type of cerebral palsy, affecting 10 to 20 percent of patients, is characterized by abnormally slow, writhing movements of the hands, feet, arms, or legs that are exacerbated during periods of stress and absent during sleep [39]. The rarest form, ataxic cerebral palsy, affects 5 to 10 percent of patients and predominately impairs balance and coordination. These patients walk with a wide-based gait and have intention tremors that complicate performance of daily activities requiring fine-motor function. Intellectual impairment occurs in about two thirds of patients with cerebral palsy. About one half of pediatric patients have seizures. Growth problems are common, as well as neurologic abnormalities such as impaired vision or hearing and abnormal touch and pain perceptions [39]. By definition, cerebral palsy is non-progressive; therefore, children who experience loss of previously acquired skills, or who show slowing of development, disappearance of reflexes, or unusual body odors should be evaluated for genetic, metabolic, muscular, or neuronal tumor disorders that precipitate neurodegenerative conditions [38].

MANAGEMENT OF CEREBRAL PALSY

Cerebral palsy cannot be cured. The World Health Organization's model of health and disease focuses

on function and is an important framework to guide modern thinking about treatment for children with cerebral palsy [64]. The goal of management of cerebral palsy is not to cure or to achieve normalcy but to increase functionality, improve capabilities, and sustain health in terms of locomotion, cognitive development, social interaction, and independence. The best clinical outcomes result from early, intensive management [39]. Optimal treatment in children requires a team approach. A modern team approach focuses on total patient development, not just on improvement of a single symptom. Treatment programs encompass physical and behavioral therapy, pharmacologic and surgical treatments, mechanical aids, and management of associated medical conditions. In physical, occupational, speech, and behavioral therapies, the goals include enhancing patient and caregiver interactions while providing family support [39].

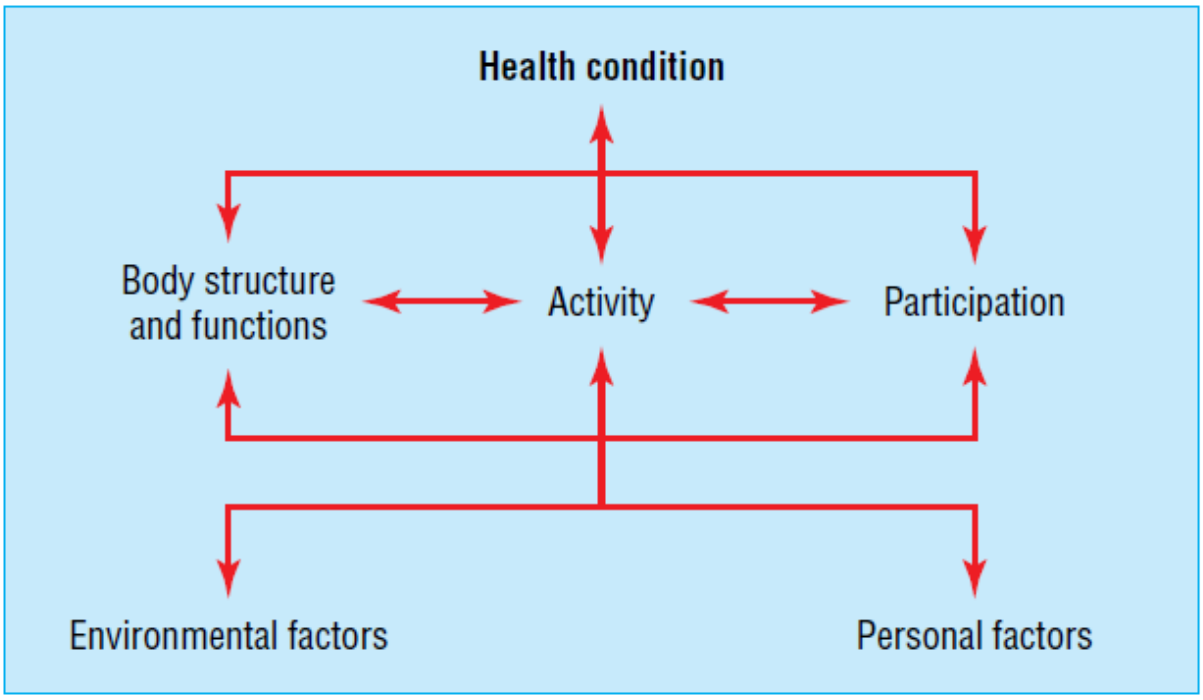

Fig: I: World Health Organization model of the international classification of functioning, disability, and health [64].

TREATMENTS OF CEREBRAL PALSY

The types of treatment for patients with cerebral palsy depend on the patient's specific symptoms and range from physical therapy to medication use and surgery. Global Strategies Neurodevelopmental treatment (i.e., the Bobath method) is a common cerebral palsy treatment strategy that aims to control sensorimotor components of muscle tone, reflexes, abnormal movement patterns, postural control, sensation, perception, and memory by utilizing specific handling techniques. A 2001 American Academy for Cerebral Palsy and Developmental Medicine (AACPDM) evidence report stated that, although patients with neurodevelopmental treatment did show some immediate improvement in dynamic range of motion, there was no consistent evidence that neurodevelopmental treatment changed abnormal motoric responses, slowed or prevented contractures, or facilitated more normal motor development of functional motor activities [65].

Another specific cerebral palsy treatment, conductive education, was reviewed by AACPDM in 2003. Conductive education emphasizes an integrated model of education and rehabilitation rather than a medical approach. The panel concluded that the current literature base does not offer enough conclusive evidence for an opinion for or against conductive education as an intervention strategy [66].

PHYSICAL THERAPY

Muscle strengthening and fitness programs are popular interventions for cerebral palsy; however, advocates of neurodevelopmental treatment advise against the use of resistive exercise, because it is believed to increase spasticity [67]. Several recent studies have examined the effectiveness of resistive exercise. A study using the stretch reflex as measured by the pendulum test found that children with cerebral palsy did not demonstrate increased spasticity of the quadriceps femoris muscle immediately following strengthening exercises as compared with children without cerebral palsy. The study also showed that resistive exercise could be beneficial in muscle strengthening when muscle weakness causes dysfunction [67]. A 10- week progressive strength training program for adults who had cerebral palsy with spastic diplegia focused on the lower extremities and resulted in improved muscle strength, walking velocity, and gross motor function when standing and walking without spasticity when compared with a control group of adult patients with spastic diplegia [68].

MEDICATIONS

Botulinum toxin. Upper motor neuron syndrome often leads to common patterns of motor dysfunction and characteristic spasticity and contractures [72]. Botulinum toxin (Botox) is a formulation of botulinum toxin type A, derived from the bacterium Clostridium botulinum. This bacterium produces a protein that blocks the release of acetylcholine and relaxes muscles. Several studies have supported the use of botulinum toxin type A in the treatment of equine spasticity during walking, but a literature review did not find strong evidence to support or refute its use for the treatment of leg spasticity in patients with cerebral palsy [73,74]. All studies reviewed used at least two injection sites in each calf, targeting the medial and lateral heads of the gastrocnemius [75].

All but two of the studies reviewed utilized 3- to 8-mouse units (mu)-per-kg botulinum toxin injections. Botulinum toxin type A injections have equivalent effectiveness to serial casting; however, longer-lasting effects and patient preference were seen with injections [76]. Botulinum toxin type A, administered by ultrasound guided intra salivary gland injections, has been investigated to reduce salivary flow rate and correct pediatric drooling associated with cerebral palsy. A total dose of 30 to 50 units was diluted in a volume of 1.0 to 1.5 mL of saline. The solution was divided over two sites per gland and injected with a 25-gauge needle via ultrasound [77].

SURGICAL TREATMENTS

Selective dorsal rhizotomy is a procedure intended to minimize or eliminate spasticity by selectively cutting dorsal rootlets from spinal cord segments L1 to S2. Postoperatively, it can create proprioceptive loss, bladder or bowel dysfunction, prolonged marked hypotonia, persistent back pain, or spinal deformities. A meta-analysis of three randomized controlled trials revealed a direct relationship between the percentage of dorsal root tissue transected and functional gross-motor function improvement [80]. Muscle imbalance caused by spasticity can lead to complete dislocation of hips. The incidence of hip dislocation in children with cerebral palsy has been reported to be as high as 59 percent. Approximately one half of patients with frank hip dislocation report pain[81]. Surgical treatment options include noninvasive abduction bracing, soft-tissue releases, major reconstructive femoral and/or pelvic osteotomies, and salvage procedures such as proximal femoral resection. A common surgical procedure for the subluxating hip is the proximal femoral varus-producing osteotomy in combination with appropriate soft-tissue releases. Unilateral surgery for unilateral subluxation appears to be effective in reducing and stabilizing the spastic hip without inducing instability in the contralateral hip, pelvic obliquity, or scoliosis [82].

ORTHOSES

These are commonly used in conjunction with physical therapy, botulinum toxin types A, baclofen, and neurosurgery or orthopedic surgery to prevent inappropriate joint movements. A literature review reported poor evidence based support for the use of lower limb orthoses to prevent deformities or improve activities in children [83]. An investigation of the usefulness of bodysuits made from elastic material has demonstrated functional gains, but only one of the 12 caregivers wanted to continue use of this treatment modality because of toileting and incontinence problems with the appliance [84]. No evidence-based indication currently exists for the use of hyperbaric oxygen therapy in the management of patients with cerebral palsy [85].

Fig: II: Lateral (A), posterior (B), and anterior (C) view of an Ultraflex adjustable dynamic response (ADR) ankle-foot orthosis (AFO) (on the left side of figure) and Cascade dynamic ankle-foot orthosis (DAFO) DAFO 3.5. The ADR-AFO is seen on the left side of each part of the figure, and the DAFO is seen on the right side of each part of the figure. Note: Not all DAFO braces used in this study were included in this figure [88].

EPIDEMIOLOGY AND IMPORTANCE OF UTI

The epidemiology of UTI during childhood varies by age, gender, and other factors. The incidence of UTI is highest in the first year of life for all children (1%) but decreases substantially among boys after infancy [93]. Estimates of UTI incidence among infant boys have varied in different populations, likely due to factors such as circumcision, which has been associated with a reduction in risk of UTI. Another issue affecting estimates of incidence is the increased recognition of UTI as a potential source of febrile illness in young children. Screening studies in emergency departments suggest that up to 5% of children under the age of 2 presenting with fever have UTI, and over half of these would have been given alternative diagnoses such as otitis media had the urine not been screened as part of the study [94]. A recent population-based study from Scandinavia reported a cumulative UTI incidence rate of 7.8% for girls by the age of 7 years, more than twice the estimate of 3% reported by Winberg in the 1960s [95,96].

DEFINITION AND PATHOPHYSIOLOGY OF UTI

UTI is defined by the presence of organisms in the urinary tract, which is usually sterile. However, since asymptomatic colonization of the urinary tract can occur, other features such as the presence of inflammatory markers or follow-up cultures may be needed to definitively diagnose a UTI. Clinically important infections usually occur due to bacteria, although viruses, fungi, and parasites can also cause infection. Common nonbacterial causes of UTI include hemorrhagic cystitis from adenovirus and Candida infection in immunocompromised individuals. Common bacterial pathogens include gram-negative species such as Escherichia coli, Klebsiella, Proteus, Enterobacter, Pseudomonas, and Serratia spp. and gram-positive organisms, including group B streptococci, Enterococcus sp., and Staphylococcus aureus. In general, bacteria infect the urinary tract by ascending from the urethra, although hematogenous infection may occur in rare instances among young infants. UTI can be further subdivided into infection localized to the bladder and urethra (cystitis and urethritis) versus upper tract infection of the ureter, collecting system, and renal parenchyma (pyelonephritis). Ascending infection of the urinary tract is a complex process that has been associated with bacterial adhesion, virulence, and motility properties as well as host anatomic, humoral, and genetic factors [100].

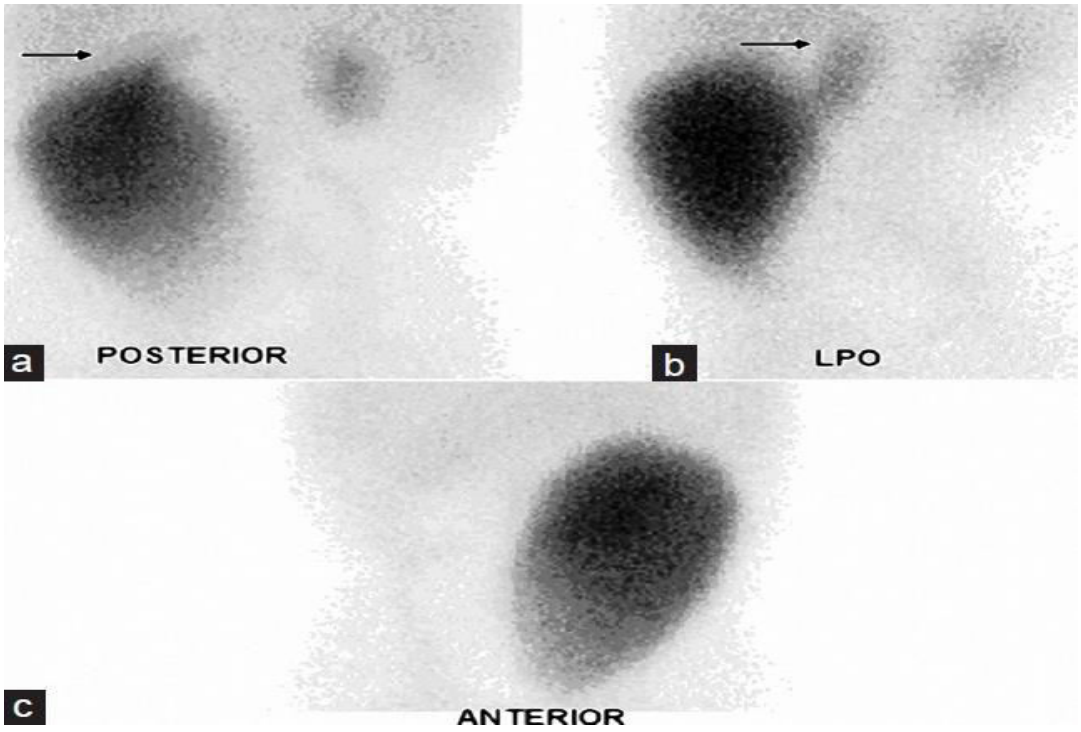

Fig: III: Poor Tc-99m dimercaptosuccinic acid (DMSA) uptake of kidneys. Left kidney (arrow) cannot be seen clearly in posterior image due to attenuation of urinary bladder (a), left kidney is seen clearly in left posterior oblique image (b), huge and high activity accumulation in urinary bladder in anterior image (c)[107].

TREATMENT OF UTI

The appropriate treatment for UTI has been a subject of recent research. Traditionally, young children with a clinical diagnosis of pyelonephritis were admitted to the hospital for intravenous antibiotics. Recently, a clinical trial by Hoberman et al. compared intravenous cefotaxime with oral cefoxime in a group of children with febrile UTI [108]. Clinical outcomes, including detection of scarring by DMSA scan at 6 months, were similar between the two groups. The power to detect small differences in outcomes was limited, particularly among subgroups who may be at increased risk, such as younger children. However, this study suggests that outpatient therapy of pyelonephritis may be appropriate in selected children. The American Academy of Pediatrics committee reviewing this topic recommended oral or parenteral antibiotics unless the child appeared "toxic, dehydrated or unable to take oral intake," in which case parenteral therapy is indicated [109].

Some clinicians routinely administer an initial dose of antibiotics parenterally at the time of evaluation. However, a recent small study assessing the efficacy of an initial intramuscular dose of ceftriaxone found no benefit compared to a 10-day course of oral antibiotics alone [110]. The choice of antibiotic may be affected by local resistance patterns and other considerations. Amoxicillin was traditionally the first-line therapy for outpatient treatment of UTI in children. However, increased rates of Escherichia coli resistance have made amoxicillin a less acceptable choice, and studies have found higher cure rates for trimethoprim-sulfamethoxazole [109].

EVALUATION AFTER UTI

The evaluation of children after a UTI was once thought to be quite straightforward and focused primarily on detecting and treating vesicoureteral reflux in order to prevent end-stage renal disease from reflux nephropathy. Hutch in 1958 and Hodson in 1960 were among the first to describe a relationship between reflux and renal scarring [113,114]. Subsequently, a relationship was established between reflux and chronic pyelonephritis [115]. Until recently, further evaluation of UTI has centered on the search for reflux with anatomic studies, including ultrasound and voiding cysto-urethrogram (VCUG). As newer radiological tests have become available, this routine work-up has been challenged, and in their recent review, the American Academy of Pediatrics subcommittee recognized the

evolving nature of this area, although continuing to recommend a VCUG and ultrasound for all children under the age of 2 presenting with a febrile urinary tract infection [116].

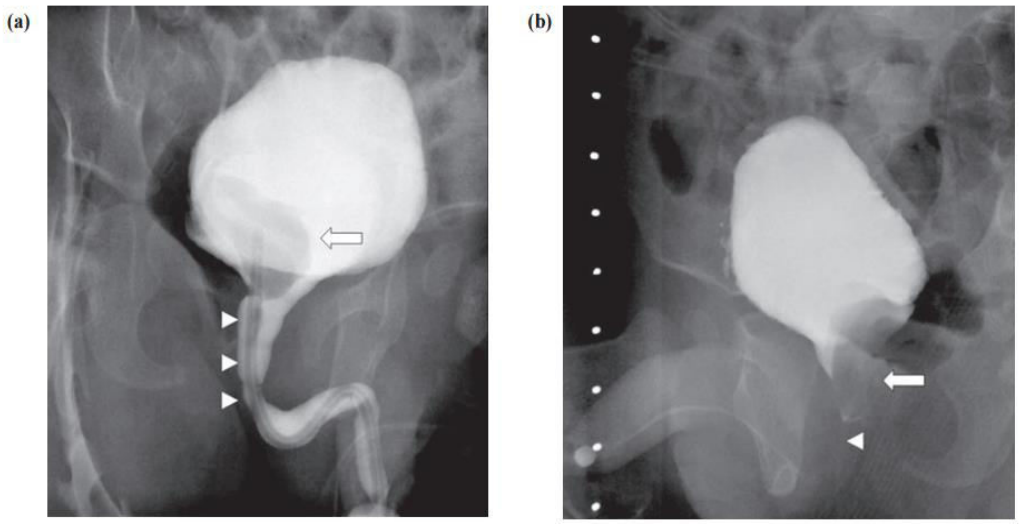

Fig: IV: Prolapsing ureterocoele causing bladder neck obstruction: (a) VCUG with urethral catheter (arrow head). Catheter prevents prolapse of ureterocoele (block arrow); (b) VCUG repeated with catheter removed illustrating prolapse of ureterocoele (block arrow). Note bladder neck obstruction (arrow head). This is only demonstrable after catheter removed [117].

MATERIALS AND METHODS:

SAMPLE SELECTION

Inclusion criteria: All cases of Cerebral Palsy diagnosed within first year after birth, aged 2-14 years and of both genders will participate in my study.

Exclusion criteria:

- Patients having inguinal hernia. (was confirmed on USG)
- Patient having undescended testicle. (On USG)
- Hypospadias's in boys. (on USG)
- Patients already on antibiotic treatment.

DATA COLLECTION METHODOLOGY

A total of 115 patients fulfilling the inclusion criteria were taken from the Pediatric department of Lahore General Hospital, Lahore. After taking a written informed consent from the parents or attendants their basic demographic information like name, age and sex was obtained. For final diagnosis of UTI (as per operational definition) urine sample for complete urinalysis and culture/ sensitivity was taken in aseptic measures and then was sent to hospital laboratory. All data was collected by me on Performa (attached).

STATISTICAL ANALYSIS

All collected data was entered in SPSS version 20 and was analyzed by same software. Frequency and Percentage was used for qualitative data such as gender and UTI. Mean ± S.D was used for quantitative data like age, duration of disease. Data was stratified for age, duration of disease and gender to address effect modifiers. Post stratified Chi-square test was used and p-value ≤ 0.05 was considered as significant.

RESULTS:

- The mean age of patients was 8±3.7 years with minimum and maximum age of 2 and 14 years. There were 47(40.87%) cases aged 2-7 years and 68(59.13%) were 8-14 years of age. **Table-1, Fig-1**
- There were 76(66.09%) male and 39(33.91%) female cases with male to female ratio of 1.94:1. **Fig-2**
- The mean duration of disease was 7 ± 3.7 years with minimum and maximum duration of 1 and 13 years. A total of 59(51.30%) cases had duration of disease < 8 years while 56(48.70%) cases had duration of disease 8-14 years. **Table-2 and Fig-3**

- According to operational definition frequency of UTI was seen in 68(59.13%) of the cases with mean number of puss cells 15.46 ± 5.6. **Fig-4**
- When data was stratified for age, gender and duration of disease a significant association was found between gender and UTI, p-value < 0.05 while we observed no association between UTI and age or duration of disease, p-value > 0.05. **Table-3,4,5**
- In cases with UTI there were 20(29.4%) and in non UTI cases there were 2(4.3%) cases that had febrile illness, with significant association, p-value 0.001. Among positive UTI cases there were 6(8.8%) cases that had E. coli with significant association and only 5(7.4%) cases in cases with UTI had heamaturia with no association, p-value >0.05. **Table-6,7,8**

TABLE-1
DESCRIPTIVE STATISTICS OF AGE (YEARS)

	Age (years)
Mean	8.0
S.D	3.7
Range	12.00
Minimum	2.00
Maximum	14.00

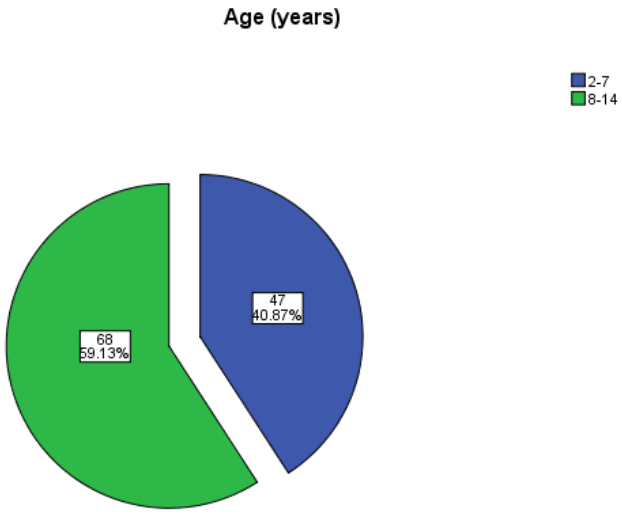

Fig-1: Frequency distribution of age groups (years)

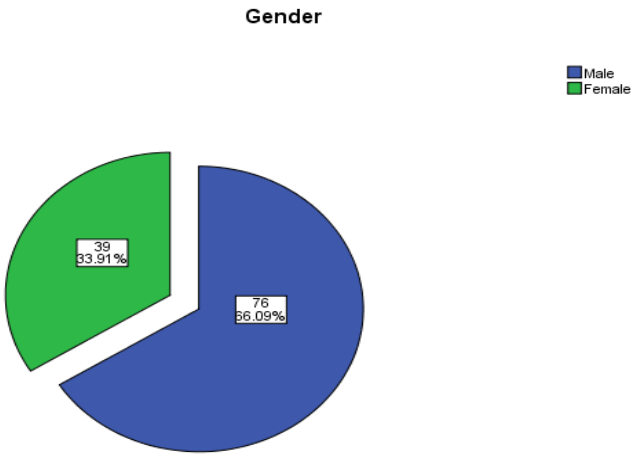

Fig-2: Gender distribution of children

TABLE-2
DESCRIPTIVE STATISTICS OF DURATION OF DISEASE (YEARS)

	Duration of disease (years)
Mean	7.0
S.D	3.7
Range	12.00
Minimum	1.00
Maximum	13.00

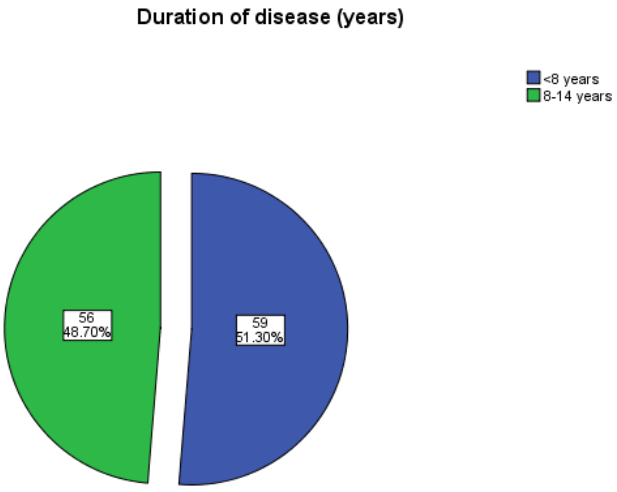

FIG-3: DISTRIBUTION OF DURATION OF DISEASE

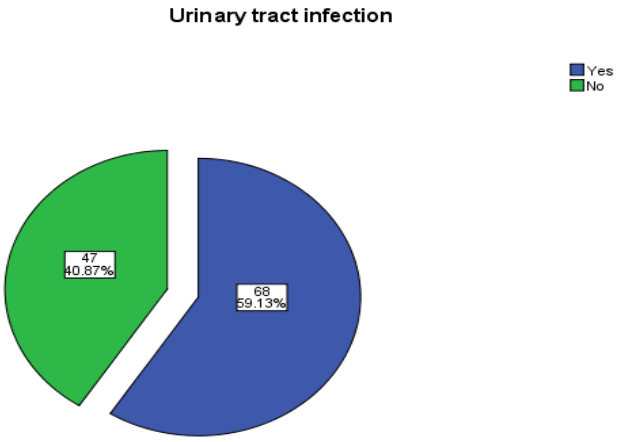

Fig-4: Frequency distribution of UTI

TABLE-3
COMPARISON OF URINARY TRACT INFECTION WITH AGE GROUPS (YEARS)

		Urinary tract infection		Total
		Yes	No	
Age (years)	*2-7*	32	15	47
		47.1%	31.9%	40.9%
	8-14	36	32	68
		52.9%	68.1%	59.1%
Total		68	47	115
		100.0%	100.0%	100.0%

Chi-square = 2.63
p-value = 0.104

TABLE-4
COMPARISON OF URINARY TRACT INFECTION WITH GENDER

		Urinary tract infection		Total
		Yes	No	
Gender	*Male*	53	23	76
		77.9%	48.9%	66.1%
	Female	15	24	39
		22.1%	51.1%	33.9%
Total		68	47	115
		100.0%	100.0%	100.0%

Chi-square = 10.43
p-value = 0.001

TABLE-5
COMPARISON OF URINARY TRACT INFECTION WITH DURATION DISEASE

		Urinary tract infection		Total
		Yes	No	
Duration of disease (years)	*<8 years*	39	20	59
		57.4%	42.6%	51.3%
	8-14 years	29	27	56
		42.6%	57.4%	48.7%
Total		68	47	115
		100.0%	100.0%	100.0%

Chi-square = 2.44
p-value = 0.119

TABLE-6
COMPARISON OF URINARY TRACT INFECTION WITH FEBRILE STATUS

		Urinary tract infection		Total
		Yes	No	
Febrile	*Yes*	20	2	22
		29.4%	4.3%	19.1%
	No	48	45	93
		70.6%	95.7%	80.9%
Total		68	47	115
		100.0%	100.0%	100.0%

Chi-square = 11.36
p-value = 0.001

TABLE-7
COMPARISON OF URINARY TRACT INFECTION WITH E. COLIE

		Urinary tract infection		Total
		Yes	NA*	
E.coli	*Yes*	6	0	6
		8.8%	0.0%	5.2%
	No	62	47	109
		91.2%	100.0%	94.8%
Total		68	47	115
		100.0%	100.0%	100.0%

*NA: not applicable

Chi-square = 4.37
p-value = 0.036

TABLE-8
COMPARISON OF URINARY TRACT INFECTION WITH HEAMATURIA

		Urinary tract infection		Total
		Yes	No	
Heamaturia	*Yes*	5	0	5
		7.4%	.0%	4.3%
	No	63	47	110
		92.6%	100.0%	95.7%
Total		68	47	115
		100.0%	100.0%	100.0%

Chi-square = 3.61
p-value = 0.057

DISCUSSION:

Cerebral palsy is characterized by motor impairment and can present with global physical and mental dysfunction. In 2001, the United Cerebral Palsy Foundation estimated that 764,000 children and adults in the United States carried the diagnosis of cerebral palsy. In addition, an estimated 8,000 babies and infants, plus 1,200 to 1,500 preschool-age children are diagnosed with cerebral palsy every year in the United States [128]. The lower urinary tract dysfunctions manifest symptomatically as urinary incontinence, urgency, frequency, hesitancy and urinary tract infection[129]. Pediatric urinary tract infections (UTI) account for 0.7% of physician office visits and 5–14% of emergency department visits by children annually [130]. Accurate diagnosis of UTI has important clinical implications; most febrile infants with UTI show evidence of renal parenchymal involvement (pyelonephritis) [131].

Possible reasons for the propensity to urinary tract infections include vesicoureteral reflux and incomplete bladder emptying resulting from detrusor hyperreflexia and detrusor sphincter dysynergia [129,132]. In addition, the impaired cognition and the inability to communicate bladder fullness and the need to void, together with an impaired mobility may also explain the tendency to urinary retention and the attendant risk of urinary tract infections [129,133]. A prevalence of 2.2% - 32.5% of urinary tract infections among cerebral palsy patients has been reported by authors from developed countries [129,134,135]. Urinary tract infection (UTI) is a problem that is frequently encountered by pediatric healthcare providers. Over recent decades, the importance of UTI has been increasingly recognized, in particular the role of UTI as an occult cause of febrile illness in young children [136]. Cerebral palsy is a common cause of childhood morbidity. This morbidity comprised seizure disorders, mental retardation, abnormalities of vision, problems with respiratory muscle, and lower urinary tract dysfunctions [137].

This study was hence designed to see the frequency of UTI in patients with cerebral palsy. The mean age of patients was 8±3.7 years with minimum and maximum age of 2 and 14 years. There were 47(40.87%) cases aged 2-7 years and 68(59.13%) were 8-14 years of age. There were 76(66.09%) male and 39(33.91%) female cases with male to female ratio of 1.94:1. In one study the prevalence and the predictors of UTI among children with CP were compared to age- and sex-matched children without CP at Federal Medical Centre, Makurdi, Nigeria, from December 2011 to May 2013. The age range was between 2 and 15 years with a mean age of 6.36±3.86 years including 30 males and 22 females with a male to female ratio of 1: 0.7 [137]. Similarly, another study reviewed the published data to see occurrence of UTI in patients with cerebral palsy and found that out of the 27 patients who underwent videourodynamic studies, there were 18 girls and nine boys. The mean age at referral was 9.9 years, with a range of 3-20 years. Nearly half of the patients referred for assessment were over 11 years old [129]. The age groups studied by other studies are compatible with our results.

In another study, 100 children with cerebral palsy were recruited out of whom, 19 patients had a history of previous UTI(s), 63% of whom also had at least some daytime urinary incontinence. Of the 81 patients without a known previous UTI, 60% were incontinent of urine and gave a prevalence of UTIs of 2.2% at admission [138]. In our study, quite

contrarily and alarmingly, according to operational definition frequency of UTI was seen in 68 (59.13%) of the cases. When data was stratified for age, gender and duration of disease a significant association was found between gender and UTI, p-value < 0.05 while we observed no association between UTI and age or duration of disease, p-value > 0.05. Moreover, the urodynamic findings in 33 patients with cerebral palsy referred with lower urinary tract symptoms were reviewed in another study. Difficulty urinating was the predominant symptom in approximately half of the patients and half of these also had hyperreflexia and urgency when full. Three patients had varying degrees of retention and the remaining 14 had difficulty initiating a urinary stream. The other half had urgency incontinence as a major presenting symptom and this was associated in nearly all cases with hyperreflexia. There were 10 adults: 5 with difficulty urinating and 5 with urgency. The more serious manifestations, such as retention, were found only in the adults, suggesting that difficulty urinating may progress in adult life [139].

Yet one other study aimed to investigate the development of bladder control in children with cerebral palsy (CP) and to determinate subgroups with deviant development of bladder control and a higher risk of not achieving urinary continence. Children and adolescents between the ages of 4 and 18 years with a diagnosis of CP, from six Dutch rehabilitation centres were included in the study (n=601). In this study, prevalence of primary urinary incontinence was 23.5%. The most important factors influencing the occurrence of urinary incontinence in CP were tetraplegia and low intellectual capacity. At age six, 54% of participants with spastic tetraplegia and 80% with spastic hemiplegia or diplegia gained urinary continence spontaneously. Of those who had low intellectual capacity, 38% were dry at this age [140].

CONCLUSION:

Hence, our study found higher frequency of UTI in children with cerebral palsy. This problem may get worse with restricted mobility. Therefore, special efforts should be made for improving quality of life of patients by physiotherapy and effective treatment.

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