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## Male sex preponderance in cerebral palsy

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### Abstract

**Introduction:** Cerebral palsy affects 2 – 3 per 1000 live children. It is a group of movement and postural disorders due to non progressive lesion in the immature brain. There are several proposed antenatal, intra natal, and post natal risk factors associated with cerebral palsy. Males are more commonly affected than females for reasons not clearly known.

**Aim:** The aim of this study is to analyse comparative incidence of cerebral palsy in male and female sex and also to analyse comparative incidence of cerebral palsy in preterm births in male and female babies.

**Materials & Methods:** The present study was a retrospective cohort study. Data was collected from the parents of 200 cerebral palsy affected children during the period 20012 – 2018 in the Rani Chandra Mani Devi Hospital, Visakhapatnam, Andhra Pradesh. The data was analysed regarding the sex distribution among the total children having cerebral palsy and also among the preterm birth children having cerebral palsy.

**Results:** Of the 200 children affected with cerebral palsy 125 were males and 75 were females accounting to 62.24% of males and 37.75% of females. Of the 125 males, 32 were born preterm and among the 75 females, 22 were born preterm. Of the total 54 preterm births with cerebral palsy the percentage contribution of male to female is 59.25% and 40.74% respectively.

**Conclusion:** This study reflects the male preponderance among the cerebral palsy affected children and also reflects the male preponderance among the preterm babies having cerebral palsy. However as this study involves a small group, study involving higher number of cerebral palsy children is needed, before coming to any final conclusions.

**Keywords:** Male preponderance, cerebral palsy, female sex, preterm births, germinal matrix, intraventricular haemorrhage, periventricular leukomalacia

### Introduction

Cerebral palsy affects 2 – 3 per 1000 live children. It is a group of movement and postural disorders due to non progressive lesion in the immature brain. There are several presumed antenatal, intranatal, and post natal risk factors associated with cerebral palsy. Males are more commonly affected than females for reasons not clearly known.

### Aim

The aim of this study is to analyse incidence of cerebral palsy in male and female sex and also to analyse comparative incidence of cerebral palsy in preterm births in male and female babies.

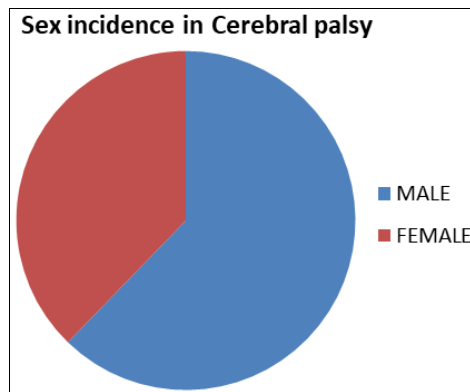
### Materials and methods

The present study was a retrospective cohort study. Data was collected from the parents of 200 cerebral palsy affected children during the period 2012 – 2018 in the Rani Chandra Mani Devi Government Hospital, Visakhapatnam, Andhra Pradesh. The data was analysed regarding the sex distribution of cerebral palsy affected children. The data was also used for the assessment of sex distribution among preterm births with cerebral palsy.

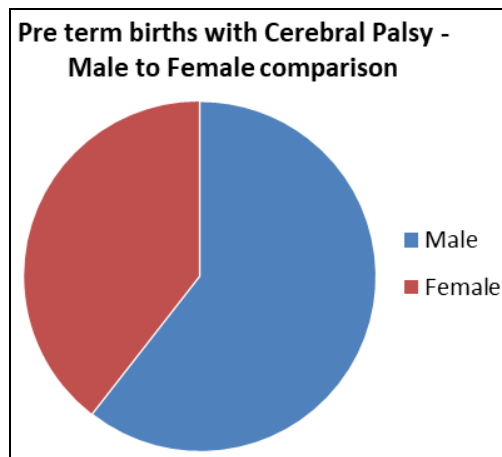
### Results

Of the 200 children affected with cerebral palsy 125 were males and 75 were females accounting to 62.5% of males and 37.5% of females. Of the 125 male babies with Cerebral palsy 32 are pre term and among 75 female babies with cerebral palsy, 22 were preterm births.

Of the total preterm births of 54, sex distribution among the preterm births having cerebral palsy was also analysed. Among the 54 preterm births having cerebral palsy, male to female percentage contribution is 59.25% and 40.74% respectively.



**Fig 1:** Showing comparative incidence of Male & Female cerebral palsy affected children



**Fig 2:** Showing comparative incidence of Male & Female among Preterm births having cerebral palsy

## Discussion

Cerebral palsy is a group of posture and movement disorders due to non progressive lesion of the infant or foetal brain. Various antenatal, intra natal, and post natal factors were observed to be associated with the birth of the cerebral palsied children in our retrospective cohort study. These factors show influence on the developing brain and its outcome, irrespective of the sex of the child but the degree of the influence may vary. The present study has been focussed on the sex preponderance in children with cerebral palsy and also the sex comparison among preterm births with cerebral palsy. The vulnerability of various structures of the brain and disability types depend on the age of the foetus at which development is disturbed [1]. Some developmental disabilities like Attention deficit hyperactivity disorder, Cerebral palsy, Autism have higher incidence in males than females [2]. The incidence of mental retardation is observed to be higher in males because of gene mutations.

In a study by Tioseco JA *et al*, on 833 infants, they found that Bilirubin levels, Intra ventricular Haemorrhages and death are more in male infants [2]. Biological susceptibility of male sex has been shown from the differences in brain organization [3-4]. Some studies have shown the protective influence of female hormones from brain damage [4-5]. The mechanisms for the difference in the vulnerability of the brain of male and

female foetus is not well understood but the physiological differences may play a role in the differential vulnerability.

Females at all ages have low mortality from respiratory problems than males indicating that females might be more resistant to hypoxia [6]. Possible mechanisms for the affection of more males with Cerebral palsy than females could be because of the protective effects of the oestrogen and Progesterone. They also showed that the incidence of stroke is also less in females than males [7-8]. In the study by Hoffman GE *et al*. the authors showed that even in traumatic brain injury cases also, progesterone plays neuro protective role against brain damage [9].

In a study by Lamari NM *et al*, the authors showed that, in bilateral spastic cases of cerebral palsy, the treatment results after conservative and operative treatment are better in females than males with respect to walking abilities and limb deformities [10]. In a study by by Zhu C *et al*, they showed that the CNS is more resistant to Hypoxic ischemia in adult females compared with males, whereas they found no sex differences in the extent of injury in neonatal mice. However, critical sex-dependent differences were demonstrated *in vivo* with regard to cellular, apoptosis-related mechanisms [11].

In a study by Mohan Makwana *et al*, conducted at Department of Pediatrics, Regional Institute of Maternal and Child Health, Umaid Hospital for Women and Children, Dr. S.N. Medical College, Jodhpur they showed the male: female ratio was 78.26% and 21.73% respectively [12]. In a study by Nabanita Das *et al*. Across-sectional epidemiological study conducted in Inpatient and Out Patient Department of Pediatrics in GMCH, Composite Regional Centre (CRC) and Sishu Sarothi, Spastics society of Assam showed in their study that 63 out of 100 cases were boys with a boy/girl ratio of 1.7:1 [13]. In a study by Ronald van Toorn *et al*. at Tygerberg Children's Hospital, one of only two hospitals in the Western Cape that offers tertiary services to children, were retrospectively reviewed over a 2-year period (2003 - 2004), out of 242 cases studied, male gender constituted 59% compared to female gender [14].

In a report on the neurological and developmental disability after extremely preterm birth, the EPI Cure Study Group found that males had increased incidence of severe disability, CP, and decrease level of cognitive functioning at 6 years of age [15].

During the period between midterm and term gestation, the branches of the surface arteries grow inside towards the ventricles. The extent of this arterial growth inside is proportional to the gestational age [16]. Hence in preterm babies the end zone is relatively deficient in blood supply and the immature blood vessels may be extremely thin and may rupture, particularly in the region of germinal matrix resulting in Germinal matrix haemorrhage [16]. This may also result in Intra ventricular haemorrhage. This type of haemorrhages may result in compression of terminal vein and may result in wide spread venous ischemia in cerebral hemisphere.

The physiologic immaturity of cerebral vasculature may result in defective intrinsic regulation [16]. Along with the vascular predisposition to injury, the developmental vulnerability of the immature oligodendrocyte also plays an important role [17] [18-19]. The oligodendrocyte is concerned with the myelination of the developing central nervous system. During the critical period of 24 – 32 weeks of gestation, the oligodendrocyte is particularly vulnerable to oxidative stress leading to decreased function or death of oligodendrocytes [20-21].

Darwin's sexual selection states that the evolutionary forces create many sex differences in the body anatomical and

physiological mechanisms. Sexual selection drives the evolution of many sex differences. In a mini review by David C. Geary, the author describes how the reproductive dynamics can result in trait elaboration in one sex and why these traits have more sensitivity to stressors. His frame work provides a conceptual model which helps to predict brain systems which are specifically vulnerable to disruption by exposure to stressors [22].

### Conclusion

It was opined in various studies that single or multiple factors mentioned above play a crucial role in affecting male baby than female and also male preterm than female preterm babies. In our study, male sex preponderance was observed among the total cerebral palsy affected children. Male sex preponderance was also observed among the preterm babies having cerebral palsy. But as our study is limited to lesser group of 200 cerebral palsy children, more in depth research with large number of cerebral palsy affected children is needed before coming to a conclusion regarding the male preponderance in cerebral palsy.

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- The authors declare that they have no personal conflicts of interest in publishing the above article.

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