

Original Research Article

## NEONATAL HYPOCALCEMIA AND VITAMIN D STATUS IN NEWBORN CHILDREN AT OUR TERTIARY CARE HOSPITAL

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### ABSTRACT

**Background:** Every year 4 million newborn deaths occur in the world, out of which one-fourth are contributed by India. Still, inadequate maternal and newborn care, lack of quality care, overdependence on higher health care centers and overlooked adolescence are few of factors that compelled Government of India to adopt the concept of continuum of care recently, as emphasized in Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH + A) strategy. Of all the deficiencies, one of the most common deficiency is the calcium deficiency (hypocalcemia) and Vitamin D deficiency (Hypovitaminosis D).

**Objectives of this study:** The objectives of this study is to estimate the levels of serum calcium and vitamin D in neonates and to find out the prevalence of hypocalcaemia.

**Materials and Methods:** A full general examination was done with special emphasis on CNS examination. Serum ionized, total calcium level and Serum 25 Hydroxy vitamin D level were investigated in all neonates. In the current study, neonatal hypocalcemia is defined by total serum calcium below 8.5 mg/dl (2.1 mmol/L), and serum ionized calcium below 4.41 mg/dl (1.1 mmol/L), as regards vitamin D hypovitaminosis when serum vitamin D below 30 ng/ml (75 nmol/L), it included vitamin D deficiency (<50nmol/L), and insufficient (50-75nmol/L). Enzyme Linked Florescent Assay (ELFA) technique mini-VIDAS instrument (Bio Mérieux Company) was used to measure serum 25 Hydroxy vitamin D3 level. Serum calcium was measured in fully automated biochemistry analyser using arsenazo method.

**Results:** The present study included a total of 120 neonates who attended our neonatology out patient clinic at our tertiary care hospital. The mean age and mean birth weight among the neonates studied was 9.4±8.6 & 2.66±0.44 respectively. 65% of neonates born by normal delivery and 35% by caesarian section. 85% neonates were born by full term and 15% were pre term. 1.66% mothers were diabetic and 4.166 % were hypertensive. 56.66% had jaundice, hypocalcemia was seen in 60% of the neonates and vitamin d deficiency was seen in 38.33% and insufficiency was seen in 51.66%.

**Conclusion:** In the present study, we found highly significant prevalence of hypocalcaemia (60%) and deficiency of vitamin D levels. There was a remarkable correlation between hypocalcemia and maternal factors such as maternal illness (For example, Diabetes) and neonatal factors such as perinatal complications and mode of feeding. It recommended the implementation of preventative strategies as an effective public health measure for maternal and neonatal health care programs through: 1) calcium and vitamin D supplementation to mothers during pregnancy and lactation; 2) oral vitamin D supplementation to neonates since birth; 3) Routine investigations of serum calcium as a part of maternal and child health care program for early detection and management of neonatal hypocalcemia; 4) Health education program to raise awareness about healthy and dietary lifestyles.

**Key-words:** vitamin D, calcium, hypocalcemia, neonates and prevalence.

## INTRODUCTION

Every year 4 million newborn deaths occur in the world, out of which one-fourth are contributed by India.[1] The Millennium Development Goals call for reduction of mortality by two-third by 2015, in comparison to the figure in 1990. However, last few years have witnessed a tardy decline of neonatal mortality rate (NMR) in India (from 52/1000 in 1990 to 29/1000 in 2013).[2] Almost 70% of all infant deaths occur within the first 28 days of life. This is the most valuable yet neglected time in terms of intervention as neonates tend to lose focus between programs intended for children and maternal health.[2,3].

Different national programs were introduced to curb neonatal as well as infant mortality. Integrated Management of Neonatal and Childhood Illness (IMNCI), Janani Shishu Suraksha Karyakram, Rashtriya Bal Suraksha Karyakram are few of them. Still, inadequate maternal and newborn care, lack of quality care, overdependence on higher health care centers and overlooked adolescence are few of factors that compelled Government of India to adopt the concept of continuum of care recently, as emphasized in Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH + A) strategy.[4]

Of all the deficiencies, one of the most common deficiency is the calcium deficiency (hypocalcemia) and Vitamin D deficiency (Hypovitaminosis D). Hypocalcemia is a common metabolic manifestation in neonates. It is a potentially life-threatening condition, with reported prevalence varying by gestational age, maternal and infant comorbidities, and perinatal factors. Neonatal hypocalcemia is classified according to its onset to early onset which manifests within the first 72 hours of birth and delayed onset after 3 days of birth. Calcium is the most abundant mineral in the human body. Ionized calcium is essential for many biochemical functions. Hypocalcemia is usually asymptomatic disease but may present with lethargy, vomiting, abdominal distension, poor muscle tone, or poor feeding, and irritability.

Another common manifestation of hypocalcemia is tetany characterised by irritability, seizures and muscle spasms. Vitamin D and its metabolites are fat soluble pro-hormones. In addition to their well-known classic functions of hemostasis of calcium, magnesium, and phosphorus level and keeping skeletal integrity, there are non- classic functions which are related to promoting insulin

secretion and action, lung development, antibacterial effects, immune regulation and controlling blood pressure. Some common signs of Hypovitaminosis D are delayed closure of anterior fontanelle, pepperpot skull, rickety rosary, craniotabes etc. Nutritional status of mothers has a strong effect on fetal development; maternal supplementation of vitamin D and calcium during pregnancy reflects neonatal vitamin D and calcium level. Maternal calcium supplementation reduces the risk of preterm birth which is the leading cause of neonatal mortality. The current study aims to assess the prevalence of hypocalcemia in outpatient clinic neonates and assess its relation to vitamin D.

### **OBJECTIVES OF THE STUDY:**

The objective of the current study is to determine the levels of calcium and vitamin D and find out the prevalence of hypocalcaemia among newborn children at our tertiary care hospital.

### **MATERIALS AND METHODS**

**Source of Data:** A Hospital Based cross sectional study conducted in the department of pediatrics in association with clinical biochemistry laboratory at our tertiary care hospital.

**Study design:** cross-sectional study

**Study subjects:** Neonates under 28 days of life seeking neonatal

**Sample size:** we included a total of 120 neonates as per the inclusion and exclusion criteria.

**Inclusion criteria:** Neonates under 28 days of life seek neonatology outpatient clinic medical care.

**Exclusion Criteria:** congenital anomalies, neonates on medication, neonates with metabolic disorders are excluded from the study.

**Data collection:** A full general examination was done with special emphasis on CNS examination. Serum ionized, total calcium level and Serum 25 Hydroxy vitamin D level were investigated in all neonates. In the current study, neonatal hypocalcemia is defined by total serum calcium below 8.5 mg/dl (2.1 mmol/L), and serum ionized calcium below 4.41 mg/dl (1.1 mmol/L), as regards vitamin D hypovitaminosis when serum vitamin D below 30 ng/ml (75 nmol/L), it included vitamin D deficiency (<50nmol/L), and insufficient (50-75nmol/L). Enzyme Linked Florescent Assay (ELFA) technique mini-VIDAS instrument (Bio Mérieux Company) was used to measure serum 25 Hydroxy vitamin D3 level. Serum calcium was measured in fully automated biochemistry analyser using arsenazo method.

**Statistical Analysis:** Significance of differences of average sodium and potassium levels in two groups were evaluated statistically using Student's t test. (p value <0.05 was significant)

### **RESULTS**

We included a total of 100 patients (Group 1, n=50 & Group 2, n= 50) based on inclusion and exclusion criteria.

**Table 1: Shows comparisons of demographic profile and laboratory parameters of study subjects.**

Parameters	Neonates	Percentage
Age (in years)	9.4±8.6	
Mean birth weight	2.66±0.44	
<b>Mode of delivery</b>		
Normal delivery	78	65
Caesarean Section	42	35
<b>Gestational age</b>		
Full term	102	85
Pre term	18	15
<b>Nature of mother illness</b>		
Nil	112	93.33
Diabetes	2	1.66
Hypertension	5	4.166
<b>Associated Jaundice</b>		
Present	68	56.66
Absent	52	43.33
<b>Calcium levels</b>		
Normal	48	40
Hypocalcemia	72	60
Mean ionized calcium (mmol/L)	0.97±0.18	
<b>Vitamin D levels</b>		
Deficient	46	38.33
Insufficient	62	51.66
Mean vitamin D (ng/mL)	75.6±18.97	

## DISCUSSION

The present study included a total of 120 neonates who attended our neonatology out patient clinic at our tertiary care hospital. The mean age and mean birth weight among the neonates studied was 9.4±8.6 & 2.66±0.44 respectively. 65% of neonates born by normal delivery and 35% by caesarian section. 85% neonates were born by full term and 15% were pre term. 1.66% mothers were diabetic and 4.166 % were hypertensive. 56.66% had jaundice, hypocalcemia was seen in 60% of the neonates and vitamin d deficiency was seen in 38.33% and insufficiency was seen in 51.66%.

Our study results are in agreement with an Iranian study that reported that 100% of neonates included in the study had neonatal hypocalcemia; The percentage of hypocalcaemia in two studies in Kenya and one in Yemen were much lower if compared to our results (21.5%, 34%, and 17.8% respectively).[5-7] Late hypocalcemia was more frequent (68.4%) than early hypocalcemia (31.6 %) in the current study. This result is in agreement with a study conducted in Qatar with 97% late hypocalcemia. These results were not in consistence with other studies in India and Iran which reported that early hypocalcemia was more frequent than late hypocalcemia. [8,9] The prevalence of hypovitaminosis D (<75 nmol/L) in the current study was 38%; in contrast, an Iranian study

reported a prevalence of 85%, 90% in an Indian study and 83% in Polish.[10,11] This low prevalence in our study is as 80% of mothers were inhabitant rural areas; they depend in their nutrition on butter, eggs, milk, and cheese which are rich in calcium and vitamin D, they are also exposed to the sun during the majority of the day in the field. In addition to the implementation of the American Academy of pediatrics recommendation of vitamin D supplementation (400 IU/day) to neonates since birth till 2 years of age. Endocrine Society recommends vitamin D levels of 30 ng/ml (50 nmol/L), but to guarantee sufficiency and because of the vagaries of some of the assays, the recommended level is between 40 and 60 ng/mL for both children and adults.[12] That means we also had another 45% of neonates who need to take supplementations, as 83% of the study group were less than 40 ng/ml (100 nmol/L).

## **CONCLUSION:**

In the present study, we found highly significant prevalence of hypocalcaemia (60%) and deficiency of vitamin D levels. There was a remarkable correlation between hypocalcemia and maternal factors such as maternal illness (For example, Diabetes) and neonatal factors such as perinatal complications and mode of feeding. It recommended the implementation of preventative strategies as an effective public health measure for maternal and neonatal health care programs through: 1) calcium and vitamin D supplementation to mothers during pregnancy and lactation; 2) oral vitamin D supplementation to neonates since birth; 3) Routine investigations of serum calcium as a part of maternal and child health care program for early detection and management of neonatal hypocalcemia; 4) Health education program to raise awareness about healthy and dietary lifestyles.

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