ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

ORIGINAL RESEARCH

To evaluate the impact of vitamin D status at birth and in the mother's plasma on the risk of sepsis

[1]Dr. Ajit Anand Asati, [2]Dr. Ajay Singh Hurmale, [3]Dr. Prince Agrawal, [4]Dr. Atul Jain

[1]Assistant Professor, Department of Pediatrics, Bundelkhand Medical College, Sagar, Madhya Pradesh, India
[2]Assistant Professor, Department of Anaesthesia, Bundelkhand Medical College, Sagar, Madhya Pradesh, India
[3]SNCU Incharge - District hospital, Sagar, Madhya Pradesh, India
[4]Associate Professor, Department of Pathology, Bundelkhand Medical College, Sagar, Madhya Pradesh, India

Corresponding author
Dr. Atul Jain
Associate Professor, Department of Pathology, Bundelkhand Medical College, Sagar, Madhya Pradesh, India
Email: jainkatul23@gmail.com

Received: 15 December, 2022 Accepted: 18 January, 2022

Abstract
Background: In the first month of life, the presence of infection symptoms, with or without bacteremia, is diagnostic of neonatal sepsis. It's the leading cause of mortality and illness among infants. The number of newborns diagnosed with sepsis during the first week of life ranges anywhere from one to eight for every thousand live births. Neonatal sepsis may be broken down into three distinct categories: early-onset, late-onset, and very late-onset sepsis
Aims and Objective: To evaluate the impact of vitamin D status at birth and in the mother's plasma on the risk of sepsis.
Materials and methods: All infants presenting with symptoms and test evidence consistent with early onset sepsis in the first 72 hours of life were considered cases. All newborns less than 72 hours old who remained in the post natal unit with their mothers and showed no evidence of clinical/laboratory infection were included as controls. There were a total of 110 moms and their newborns analysed in this study: 55 in the case group and 55 in the control group.
Results: Both maternal and newborns mean 25-OH Vitamin D levels are low and statistically significant ($p<0.001$) in study group as compared to control group. The mean 25-OH cholecalciferol levels among term is 17.34ng/ml(±4.8) and in preterm is 13.5ng/ml(±2.9) and this data is statistically significant(p-0.04).
Conclusion: Infant sepsis was shown to have strong ties to low vitamin D levels in the mother's blood and the umbilical cord blood.
Keywords: Vitamin D, maternal, Newborn

Introduction

In the first month of life, the presence of infection symptoms, with or without bacteremia, is diagnostic of neonatal sepsis. It's the leading cause of mortality and illness among infants. [1,2]The number of newborns diagnosed with sepsis during the first week of life ranges

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

anywhere from one to eight for every thousand live births. Neonatal sepsis may be broken down into three distinct categories: early-onset, late-onset, and very late-onset sepsis. [3] Clinical signs of sepsis are often rather minor; nonetheless, the disease may quickly grow and worsen, and it can result in mortality anywhere from a few hours to many days after it has been diagnosed. [4] Early onset sepsis generally appears during first 72 hours[2]. According to the findings of studies that have been carried out, the incidence of EOS ranges from one to two instances for every one thousand live births [3]. This condition may appear as asymptomatic bacteremia, widespread sepsis, pneumonia, and/or meningitis. Many diagnostic biomarkers had been investigated up to this point, but none had attained the goal of achieving a speedy and accurate diagnosis, particularly of infants who were infected. [5] Premature rupture of membrane (PROM) for more than 18 hours, maternal diabetes, pre-eclampsia, chorioamnionitis, maternal fever of more than 38 degrees, multiple obstetric procedures, foul-smelling liquor, multiple gestation, and urinary tract infection are all risk factors among mothers that lead to early onset sepsis in newborns. Other risk factors include multiple gestation and urinary tract infection.

Aims and Objective

To evaluate the impact of vitamin D status at birth and in the mother's plasma on the risk of sepsis

Materials and Methods

This is a research in the form of a prospective observational investigation that was carried out between September 2017 and July 2018. The N.I.C.U. of C.R. Gardi Hospital (C.R.G.H) and the related hospital of R. D. Gardi Medical College in Ujjain are the locations where the research is being carried out. All of the newborns who were admitted to the Neonatal Intensive Care Unit (NICU) at the Department of Pediatric Medicine at RDgardi Medical College in Surasa Ujjain and met the criteria for early-onset sepsis were included in this study. The newborns who had not shown any signs of clinical or laboratory infection, were younger than 72 hours old, and had remained in the same room as their mothers in the post-natal ward at the Department of Obstetrics and, R.D. Gardi Medical college in Surasa Ujjain. These children were included in the control group. This research had 110 moms, with 55 mothers participating in the case group and 55 mothers participating in the control group. Also, this study included 110 newborns, with 55 participating in each group.

Methodology

The thorough history, clinical observations, and investigations were recorded using a tried and true Proforma. An extensive prenatal history was collected from the mother/legal guardians of the infant and from the mother's medical records, including information on the mother's age, religion, and risk factors. Newborns' complete natal and postnatal histories were collected. This included their ages, gestational ages, genders, feeding methods, pre-lacteal feeds, and presenting symptoms. The patient was subjected to a thorough physical examination that included measurements of their pulse and respiration, body temperature, capillary refill time, colour, and oxygen saturation. This pregnancy's age was calculated using both the woman's latest menstrual cycle and the New Ballard Score. All selected patients had blood culture and vitamin D samples provided. Hemoglobin, total leukocyte count, direct leukocyte count, C-reactive protein, electrolytes, and random blood sugar were all tested on the 2 ml of blood drawn through peripheral venepuncture. Chest X-rays, lumbar punctures, microscopy of urine, testing of urine for fungi, culture of urine, and arterial blood gas analysis were also performed when needed.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

Following established protocols, blood was drawn without contamination. Standard technique on blood and Macconkey agar called for 0.5 ml of blood to be combined with 10 ml of citrated glucose broth and inoculated. After 48 and 72 hours, the colonies were studied.
The MAGLUMI 25-OH VITAMIN D Kit, made by Snibe diagnostics, was used for the vitamin D determinations. Kothari Diagnostic facility in Bhopal ran the tests using a MAGLUMI fully-auto chemiluminescence immunoassay (CLIA) analyser.
For the quantitative determination of vitamin D in human serum, the MAGLUMI 25-OH VITAMIN D test employs a two-incubation chemiluminescence immunoassay.

Data analysis
EpiData Entry (Version 3.1, EpiData Software Association, Odense, Denmark) was used to input the data, and Stata was used for the statistical analysis (Version 13.0, Statacorp. Texas, USA). A statistically significant result was regarded to have a p-value of less than 0.05. STATA 10.0 was used in order to carry out the statistical analysis.

Results
Table 1: Distribution of Study Population

Category	Cases	Control
Males	28 (50.90%)	30 (54.5%)
Females	27 (49.09%)	25(45.4%)
TOTAL	55 (100%)	55 (100%)

Total 110 newborns were enrolled out of which 55 were cases and 55 were control. Out of 55 cases, 28(50.90%) were Males and 27 (49.09%) were Females and in control 30 (54.5%) were Males and 25 were Females (45.4%).

Table 2: Distribution of the Newborns according to Maternal Age

	Study group(n=55)	Control(n=55)
<20 years	9 (16.3%)	12 (21.8%)
20-30 years	37 (67.2%)	32 (58.1%)
>30 years	9 (16.3%)	11 (20%)
Total	55	55

This table shows that maximum mothers in our study populations in both cases 37(67.2%) and controls 32 (58.1%) belonged to age group 20-30 years. Mean maternal age in study group is 24.4 years and 26.1 years in control group.

Table 3: Distribution of the Newborns according to Birth weight

Weight	Case & Control	
	Cases	Controls
<=2.5	15 (27.27%)	23 (41.8%)
>2.5	40 (72.7%)	32 (58.1%)
Total	**55**	**55**

This table shows that in both cases 40(72.7%) and control 32 (58.1%) , weight of newborns were more than 2.5 kg.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

Table 4: Distribution of the Mothers according to mode of delivery

Mode of delivery	Cases(n=55)	Control(n=55)
Vaginal	37 (67.2%)	35 (63.6%)
C- section	18 (32.7%)	20 (36.3%)
Total	55	55

Table 5: Presenting clinical features of cases

System	Symptoms	Study group with specified symptoms	Study group with specified system involvement
Respiratory system	Respiratory distress	26 (47.27%)	32(58.1%)
	Apnea	6 (10.9%)	
Central nervous system	Dullness	3 (5.4%)	5(9.09%)
	Excessive crying	1 (1.8%)	
	Neonatal seizures	1 (1.8%)	
Gastrointestinal Tract	Vomiting	4 (7.2%)	6 (10.09%)
	Abdominal distention	2 (3.6%)	
Miscellaneous	Not accepting feed	3 (5.4%)	12(21.8%)
	Pyrexia	2 (3.6%)	
	Hypothermia	5 (9.09%)	
	Icterus	1 (1.8%)	
	Pustules>10	1 (1.8%)	

In the above table the most common symptom was respiratory distress (47.27%), followed by apnea(10.9%) and hypothermia(9.09%) and most common system involved was respiratory system(58.1%) .

Table 6: Mean 25-OHD levels in mothers and newborns of study and control group

	Study group (n=55)	Control group (n=55)	P- value
Maternal25-OH Vitamin D(ng/ml), mean± s.d.	20.2±6.8	32±3.2	<0.001
Newborns 25-OH Vitamin D (ng/ml), mean±s.d.	14± 4.8	23± 2.7	<0.001

This table show that both maternal and newborns mean 25-OH Vitamin D levels are low and statistically significant (p<0.001) in study group as compared to control group.

Table 7: Mean 25-OH cholecalciferol levels among preterm and term newborns inthe study group

	Term(n-40)	Preterm(n-15)	P value
Mean 25-OH cholecalciferol	17.34ng/ml(±4.8)	13.5ng/ml(±2.9)	0.04

The mean 25-OH cholecalciferol levels among term is 17.34ng/ml(±4.8) and in preterm is 13.5ng/ml(±2.9) and this data is statistically significant(p-0.04).

Discussion

The gender breakdown of the 55 cases was evenly split between men (50.9%) and females (40.9%). There were 54.6% men and 45.4% females in the placebo group. The majority of those in the control group were male. Similar to the current research, Cetinkaya et al.[6] used

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

a sample size of 100, with 50 cases and an equivalent number of controls, and found that men were about evenly distributed across the study and control groups (52% vs. 58%, respectively). Sixty-eight percent of moms in the experimental group fell in that age range, but only 58.1% of those in the control group did. Therefore, the average mother in the experimental group is 24.4 years old, whereas the average mother in the control group is 26.1 years old. This research's sample is younger than the sample used by Cetinkaya et al.[6], who observed a mean mother age of 26.8 years in their study group and 28.4 years in the controls.

In the study group 72.7% newborns had birth weight >2.50 kg, among them 56.3% were full term AGA. 58.1% newborns had birth weight >2.50kg in control group out of which 51% were full term AGA. Similarly in study done by Watkins et al[7] found that 56.3% of newborns were full term. No other study has classified newborns into LGA, SGA or AGA in both term and preterm newborns.

The mean value of 25-OH cholecalciferol levels among mothers in the study group was 20.2ng/ml(±6.8) and in control group was 32.2 ng/ml(±3.2). The vitamin D levels was found to be significantly lower in the study group as compared to the controls and this data is highly statistically significant ($p<0.001$). Similarly in the study conducted by Cetinkaya et al[6] the mean 25-OHcholecalciferolin study group were 22.2ng/ml(±6.2) and in controls were 36.2ng/ml(±1.8) and this correlation was found to be highly statistically significant ($p<0.001$). This found in the present study and Cetinkaya study (20.2ng/ml vs 22.2ng/ml) are very similar.

In the present study the mean value of 25-OH cholecalciferol among newborns was 14ng/ml(±4.8) , while among control group it was found to be 23ng/ml(±2.7) and this correlation is found to be highly statistically significant ($p<0.001$). Vasantha et al[37] conducted a study in Telangana in which mean 25OH cholecalciferol levels among newborns in study groups was 14.69ng/ml(±4.45) and among healthy newborns were 26.46ng/ml(±2.01) and this correlation was found to be statistically significant($p<0.01$). The study conducted by Cetinkaya et al[6] found that the mean 25-OH cholecalciferol among newborns in study group was 8.6ng/ml(±3.1) and in controls was 19.0ng/ml(±4.8) and this correlation is found to be statistically significant ($p<0.001$). In the study conducted by Cetinkaya , mean 25-OH cholecalciferol levels were much lower in both study group{8.6ng/ml(±3.1) vs 14ng/ml(±4.8)} and control{19.0ng/ml(±4.8)vs26.46ng/ml(±2.01)}. The possible explanation for this difference can be that study conducted by Cetinkaya in 2014 in Istanbul which is predominantly a Muslim dominating area while the present study was conducted in a Hindu dominating area so there can be cultural differences. As the study was conducted in 2014 in Istanbul, Turkey which is predominantly a Muslim dominating area. In the present study the mean 25-OH cholecalciferol levels among term is 17.34ng/ml(±4.8) and in preterm is 13.5ng/ml(±2.9) and this data is statistically significant(p-0.04). Similar study conducted by Wynn et al.

Conclusion

Infant sepsis was shown to have strong ties to low vitamin D levels in the mother's blood and the umbilical cord blood.

References

1. Polinski C. The value of white blood cell count and differential in the prediction of neonatal sepsis. NeonatalNetw 1996;15:13-23
2. Misra RN, Jadhav SV, Ghosh P, GandhamN, Angadi K, Vyawahare C. Role of sepsis screen in the diagnosisof neonatal sepsis. Med J DY PatilUniv 2013;6:254
3. National neonatology forum guidelines 2014 on management of neonatal sepsis-www.nnfpublication.org

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 02, 2023

4. Meem M, Modak JK, Mortuza R, Morshed M, Islam MS, Saha SK. Biomarkers for diagnosis of neonatal infections: A systematic analysis of their potential as a point-of-care diagnostics. Journal of Global Health. 2011;1(2):201-209.
5. Chhabra, G.S. &Sodhi, M.K. & Sharma, M. Clinical, hematopathological, and bacteriological profiles in neonatal septicemia and meningitis. Perinatology.2016; 17. 54-61.
6. Cetinkaya M, Cekmez F, Buyukkale G, Erener-Ercan T, Demir F, Tunc T, Aydın FN, Aydemir G; Lower vitamin D levels are associated with increased risk of early-onset neonatal sepsis in term infants.J Perinatol. 2015;35(1):39-
7. Watkins, R.R.; Lemonovich, T.L.; Salata, R.A. An update on the association of Vitamin D deficiency withcommon infectious diseases. Can. J. Physiol. Pharmacol. **2015**, 93, 363–368
8. Vasantha AR, Kutty SN, Joseph Theodore RB. Neonatal sepsis: Aetiological agents and risk factors. J AcadClinMicrobiol 2017;19:36-41
9. Wynn JL. Defining Neonatal Sepsis. *Current opinion in pediatrics*. 2016;28(2):135-140
10. Dent CE, Gupta MM. Plasma 25-hydroxyvitamin-D-levels during pregnancy in Caucasians and in vegetarian and non-vegetarian Asians. Lancet. 1975;2:1057–60.
11. Walker VP[1], Zhang X, Rastegar I, Liu PT, Hollis BW, Adams JS, Modlin RL; Cord blood vitamin D status impacts innate immune responses;J ClinEndocrinolMetab. 2011 Jun;96(6):1835-43
12. Philip T. Liu, Steffen Stenger, Huiying Li, Linda Wenzel, Belinda H. Tan, Stephan R. Krutzik, Maria Teresa Ochoa, Jürgen Schauber, Kent Wu, ChristophMeinken, Diane L. Kamen, Manfred Wagner,RobertBals, Andreas Steinmeyer, Ulrich Zügel,Richard L. Gallo, David Eisenberg, Martin Hewison, Bruce W. Hollis,John S. Adams, Barry R. Bloom, Robert L. Modlin; Toll-Like Receptor Triggering of a Vitamin D-Mediated Human Antimicrobial Response .Science 24 Mar 2006:311(5768): 1770-1773
13. Birgul Say, MD, NurdanUras, MD, Suzan Sahin, MD, HalilDegirmencioglu, Effects of cord blood vitamin D levels on the risk of neonatal sepsis in premature infants Korean J Pediatr 2017;60(8):248-253
14. Gad GI, Abushady NM, Fathi MS, Elsaadany W; Diagnostic value of anti-microbial peptide, cathelicidin in congenital pneumonia. J Matern Fetal Neonatal Med. 2015;28(18):2197-200.
15. Chen S, Sims GP, Chen XX, Gu YY, Chen S, Lipsky PE 2007 Modulatoryeffects of 1,25-dihydroxyvitamin D3 on human B cell differentiation. J Immunol179:1634–1647
16. Bodnar LM, Catov JM, Simhan HN, Holick MF, Powers RW, Roberts JM. Maternal vitamin D deficiency increases the risk of preeclampsia. J ClinEndocrinolMetab. 2007;92:3517–22.18DeLuca HF 2004 Overview of general physiologic features and functions of vitamin D. Am J ClinNutr 80:1689S–1696S.