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BIOCHEMICAL PROFILING OF CORD BLOOD SAMPLES IN TERM HEALTHY NEONATES; A STUDY REPORT

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ABSTRACT

Introduction: Cord blood biochemical parameters reflect the health status of the newborn which may be subjected to alterations due to inflammatory, metabolic and immunological disorders during pregnancy. Cord blood can act as a screening aid to identify various metabolic disorders and also facilitate early detection, diagnosis and intervention of the conditions that can affect a child's long term health or survival. **Aim and Objective**: The present study was carried out for the purpose of screening the term neonates and to establish the reference range of Biochemical parameters of umbilical cord blood. **Methods**: 75 Term Neonates with normal birth weight born out of uneventful pregnancy were taken as representative sample from Jamnagar city after the careful sampling of cord blood .The processing of the blood samples and biochemical analysis of parameters were carried out as per the laboratory standard operating procedure. **Result:** The observed range of Biochemical parameters (±SD) for Glucose, Serum Cholesterol was found to be 58.83 – 88.84 mg/dl and 36.65 – 84.17 mg/dl, Blood Urea. Serum Creatinine exhibited range of 10.18 – 20.33 mg/dl, and 0.61 – 0.89 mg/dl. Total Protein, Serum Albumin, Serum Globulin, were 4.96 – 6.06 gm/dl , 3.01 – 3.53gm/dl, 1.73 – 2.62 gm/dl respectively which shows close proximity to proposed biochemical ranges obtained in the other study except Sr. Cholesterol (68±27) and blood Urea (20±5) which were comparatively lower in the present study. **Conclusion:** Umbilical cord blood analysis for biochemical parameters should be routinely practised for evaluation of the status of the newborn and also the obtained biochemical reference range can be used as a guide for future analysis.

KEYWORDS: Umbilical Cord Blood, Term Neonates, Biochemical reference range.

INTRODUCTION

Umbilical cord blood reflects the neonatal conditions like inborn metabolic errors, asphyxia induced acidosis etc. providing a valuable objective evidence to the clinician for early diagnosis and treatment of the neonatal conditions which may seem apparently normal at birth. The health status of the newborn is largely influenced by the maternal conditions during the pregnancy. These conditions affect the environment in which the foetus is developing and may produce metabolic, immune, vascular, hemodynamic and renal alterations.[1] As a result, various diseases such as poor Glucose Homeostasis, Insulin Resistance, Type 2 Diabetes, the Metabolic Syndrome, Obesity, Hypertension, Osteoporosis, Cardiovascular disease, Endothelial Dysfunction and Coronary Heart Disease may be a consequence of these alterations.[2] Evaluation of Cord blood biochemical parameters may help in identifying these conditions in newborn which may later affect the adult life. In many laboratories, cord blood samples are routinely available whereas it is more difficult to obtain blood from healthy neonates to determine reference ranges. Even well known reference texts such as Paediatric Clinical Endocrinology[3] have to contend with numerous instances of Paediatric reference ranges obtained on very small number of subjects. A study has shown that cord blood total protein levels can act as screening aid for Idiopathic Respiratory Distress Syndrome. In 33 infants out of 34 with developed IRDS showed cord blood total protein concentration of 4.6gm per 100ml or less.[4] Hence, understanding the clinical value of determining the biochemical parameters of umbilical cord blood, this study has been considered.

AIM AND OBJECTIVE

The objective of this work was to analyze different biochemical parameters for the purpose of screening the term Neonates with the aim to evaluate the health status

and to set a biological reference interval for some significant Biochemical parameters of umbilical cord blood in healthy Newborns as a guide for future research studies.

MATERIALS AND METHODS

The present study was carried out in the clinical laboratory, Department of Biochemistry, Institute for post graduate teaching and research in Ayurveda, Gujarat Ayurveda university, Jamnagar, Gujarat over a period of six months from the month of June to November 2018. The study was initiated after the approval of institutional ethical committee.75 term healthy Neonates were randomly selected after obtaining informed consent from either of the parents which were born out of uneventful, singleton pregnancy with birth weight of 2.5 to 3.5 kg, APGAR Score 6-8 in 1 minute, having no H/o Birth Asphyxia, Congenital Anomalies or other birth complications. Conditions like Preterm and Low Birth weight babies, congenital abnormalities were excluded from the study. Umbilical Cord Blood was drawn from the umbilical vein with the help of 5cc disposable syringe at the cord length of 10-15 cm away from the placenta. Blood samples of 3cc were collected immediately after the delivery of the placenta, in a sterile clot activator gel contained vaccutainer.The processing of the blood samples and biochemical parameters were analyzed by using Chemistry Auto analyzer (Mindray, BS-200), as soon as the samples were collected by following the laboratory standard operating procedure of Biochemistry department, IPGT&RA,GAU, Jamnagar. The referred methods for the quantitative assessment and their sources are listed in table1.

STATISTICAL ANALYSIS

Data entry was done in Microsoft excel using Sigma Stat after obtaining the evaluated value of umbilical cord blood serum parameters. Thereafter, Mean, ± SD, reference range interval were derived.

Table 1: Different Methods and sources used for the quantitative assay.[5,6,7]

Sl.no.	Parameters	Methods	Reagent kits used
1	RBS	God-pod	Erba kit
2	Sr.cholesterol	Chod-pap	Erba kit
3	SGPT	Ifcc method	Meril
4	SGOT	Ifcc method	Meril
5	Bilirubin total	Diazo method of pearlman & lee	Erba kit
6	Bilirubin direct		
7	Sr.creatinine	Modified jaffe's method	Diasys
8	Total protein	Modified biuret	Erba kit
9	Albumin	Bromocresol green	Erba kit
10	Globulin	By calculation	
11	Ag ratio	By calculation	
12	Blood urea	Urease-gldh	Diasys

RESULTS

Biochemical reference range values of cord blood were established for 75 healthy Neonates and comparison was drawn with a study done on 283 newborns (control group n = 99 and pathological group n = 184) in the hospital de clinicas of the university of Buenos Aires, Argentina. The results are shown in the table 2 with their Mean, ± Standard Deviation, range interval values which shows close proximity in the values observed in the previous study except for Sr. Cholesterol (68±27) and blood Urea (20±5) which were comparatively lower in the present study. This may attribute to the fact that the differences in the range values are largely due to preferences in the habitual diet which may also serve as an indicator of nutritional status of Neonates of respective region.

Table 2: Laboratory evaluation of Mean, ±SD and Observed reference range values for determination of Biochemical parameters.

SL.NO.	Parameters	MEAN ± SD	UNITS	REFERENCE RANGE
1	Rbs	73.84 ± 15.007	mg/dl	58.83 – 88.84
2	Sr.cholesterol	60.41 ± 23.760	mg/dl	36.65 – 84.17
3	Sgpt	15.10 ± 9.0517	IU/L	6.05 – 24.15
4	Sgot	33.06 ± 15.731	IU/L	17.33 – 48.79
5	Bilirubin total	1.60 ± 0.5399	mg/dl	1.06 – 2.14
6	Bilirubin direct	0.66 ± 0.1767	mg/dl	0.48 – 0.84
7	Sr.creatinine	0.75 ± 0.138	mg/dl	0.61 – 0.89
8	Total protein	5.51 ± 0.546	gm/dl	4.96 – 6.06
9	Albumin	3.27 ± 0.260	gm/dl	3.01 – 3.53
10	Globulin	2.18 ± 0.447	gm/dl	1.73 – 2.62
11	Ag ratio	1.48 ± 0.291	-	1.19 – 1.77
12	Blood urea	15.26 ± 5.074	mg/dl	10.18 – 20.33

DISCUSSION

The intended purpose of this article is to detail the clinical value of determining some routine biochemical parameters of umbilical-cord blood. The Reference range can be used for diagnosis, treatment or prevention of disease and for greater understanding of disease process.[8] Cord blood analysis has the advantages of being easy to collect, non invasive and low rates of follow up loss as the results would be available before the mother leaves the hospital which is critical for early institution of treatment if necessary.[9]

A study conducted in the hospital de clinicas of the university of Buenos Aires, Argentina showed a statistically significant differences ($P<0.001$) in the biochemical parameters like Serum Cholesterol, Triglycerides, Potassium, SGOT, Total protein and albumin whereas non-significant difference in Glucose, Urea, Creatinine, SGOT and ALP in umbilical cord blood between Controls (n=99) and pathological group (n=184).[10] Reference values may differ among ethnic groups. A study in Kerala, India, showed total protein and Albumin in the range of 4.4-7.4 gm/dl and 1.7-3.4 gm/dl[11], wherein another study in Orissa, India, found a higher range for the same parameters between 5.07-7.65gm/dl and 3.55-4.54 gm/dl[12], while in the present study the value obtained for total protein and albumin were in between 4.96 – 6.06gm/dl and 3.01 – 3.53gm/dl respectively which is almost similar to that of study in Kerala and Argentina. The measurement of umbilical cord blood cholesterol levels of healthy babies could be used as a population screening test for the diagnosis of genetic lipid disorder like familial hypercholesterolemia.[13] There is no significant differences in the Biochemical parameters in male and female Neonates.[14]

Umbilical Cord blood analysis has a definite role for screening the nutritional and metabolic status of Newborn babies and can be an early predictor of future wellbeing. The determination of biochemical parameters range values has been established for the purpose of Neonatal Screening. Newborn Screening is a public health activity aimed at early identification of conditions for which timely intervention is expected to result in elimination or reduction of morbidity, mortality and disabilities. It is an important and effective component of preventive medicine. Inborn errors of metabolism are identified by Newborn Screening.[15]

Hence, it is important to determine the reference range interval of cord blood biochemical parameters attributing to its clinical Utility. Furthermore, the availability of age appropriate reference intervals is necessary, because the concentration of several metabolites change rapidly with age. The outcome of the present study may be affected by local factors like maternal conditions, sample collection and estimation methods used, so this study can be further done in large population sample for more accuracy and precision in the reference range values.

CONCLUSION

A very few literature is available regarding UCB biological parameters, which may vary on ethnicity, maternal and genetic factors. The Biological reference interval established can serve as a useful data in the branch of Neonatology and a guide for future UCB analysis in research studies concerning health and disease which needs to be established in every region in the era of stem cell research.

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