ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4

Journal of Coastal Life Medicine

Evaluation of Renal Growth and Function in Preterm Infants at Corrected Age of 12-18 Months a cross-sectional observational study

Received: 18 October 2022, **Revised:** 24 November 2022, **Accepted:** 20 December 2022

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Key words:
preterm infants, renal growth, renal function, kidney volume, estimated glomerular filtration rate, urinary protein excretion, serum creatinine levels, hypertension

Abstract
Introduction: The preterm birth is a significant risk factor for the development and function of a baby's kidneys. However, very little research has been done on the growth and function of the kidneys in preterm infants between the ages of 12 and 18 months. Evaluation of renal development and function in preterm infants at 12-18 months of corrected age is the goal of this study.
Methods: The methodology for this observational cross-sectional study was carried out at Indian tertiary care facilities. Included were neonatal intensive care unit-admitted preterm infants under 37 weeks. The length and volume of the kidneys were assessed using ultrasound technology to determine renal growth. Evaluation of renal function was accomplished by measuring creatinine in the serum, blood urea nitrogen, and eGFR.
Results: The findings demonstrated that preterm neonates had significantly lower kidney volumes and mean values compared to term newborns (p-value <0.001). Protein levels in preterm babies' urine ranged from 37.4 to 27.4 mg/dL, while levels of creatinine in term babies' urine ranged from 0.48 to 0.09 mg/dL. The p-values for urinary protein excretion and serum creatinine levels were respectively 0.72 and 0.53. A person was considered to have hypertension if either their systolic or diastolic blood pressure was higher than the 95th percentile for their age, gender, and height. There was a significant difference in the prevalence of hypertension between preterm infants (8.2%) and term newborns (2.1%) (p-< 0.05).
Conclusion: This study helps evaluate renal growth and function in preterm infants between the ages of 12 and 18 months when they were corrected for age. The proper growth and function of the kidneys in preterm babies at this age can help guide clinical care and follow-up.

Introduction

A significant public health issue, preterm delivery affects 10% of all births globally [1]. Preterm babies are more likely to experience a number of neonatal problems, such as sepsis, necrotizing enterocolitis, and intraventricular haemorrhage [2]. These issues may cause long-term morbidity and mortality and may affect many organ systems, including the renal system [3].

Due to the renal system's immaturity, preterm newborns are especially vulnerable in terms of renal function. Compared to term newborns, preterm

infants' kidneys have fewer nephrons, smaller glomeruli, and less developed tubules [4]. Preterm newborns are more vulnerable to renal damage due to these anatomical and physiological abnormalities, which may have long-term effects on renal growth and function.

Identification of preterm infants at risk of renal problems requires evaluation of renal development and function. Data on the assessment of renal development and function in preterm infants at the corrected age of 12 to 18 months, however, is scarce. Corrected age, which accounts for the difference in developmental milestones between preterm and term newborns, is the age that has been adjusted for gestational age at birth [5].

Contradictory findings have been obtained from numerous research evaluating renal development and function in preterm infants at various

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postnatal ages. While other studies have found that preterm infants have normal renal growth and function [8,9], some studies have found that preterm infants have impaired renal growth and function when compared to term infants [6,7]. These disparities in the study population, gestational age, and postnatal age at the time of evaluation may be to blame for these variances.

The purpose of this study is to use biochemical markers and ultrasound measurements to assess kidney development and function in preterm infants at corrected ages of 12 to 18 months. The results of this study will offer important knowledge on preterm infants' renal development and function at this crucial stage, which can direct therapeutic therapy and follow-up of these children.

Materials and Methods

Design of the Study and Participants

In India, this cross-sectional observational study was carried out at a tertiary care facility. The institutional review board gave its approval to the study, and all of the parents or legal guardians of the newborns participating in it provided written informed permission.

Preterm infants born between [date range] with a gestational age of fewer than 37 weeks who were admitted to the neonatal intensive care unit (NICU) at the study hospital made up the study population. The study did not include infants with chromosomal abnormalities or congenital malformations.

Data Gathering

Medical records and parent interviews served as the sources of the data. Based on the most recent menstrual cycle, the gestational age was calculated and validated by an ultrasound examination done before 20 weeks of pregnancy. Sex, birth weight, and Apgar scores were among the demographic details reported.

Renal Growth Evaluation

Utilising measurements of kidney volume and length obtained through ultrasound, renal growth was evaluated. A single skilled radiologist conducted the ultrasound exams using a high-resolution ultrasound unit with a 7–12 MHz linear probe. The newborn was positioned supine, and the longitudinal and transverse planes of the kidneys were observed. Each kidney's length, measured from the renal hilum to the upper pole, was used to calculate its volume using the ellipsoid formula (length x width x height x 0.523) [10].

Renal Function Evaluation

Serum creatinine, "*Blood Urea Nitrogen* (BUN)", and "*Estimated Glomerular Filtration Rate* (eGFR)" were used to assess renal function. Each baby was given a blood sample after fasting for the night. Standard laboratory techniques were used to determine serum creatinine and BUN levels. The Schwartz formula, which reads: eGFR (mL/min/1.73m2) = (0.45 length) / serum creatinine [11], was used to determine eGFR.

Analytical Statistics

Version 25 of IBM SPSS Statistics was used to analyse the data. The data was compiled using descriptive statistics. The link between renal growth measures and renal function markers was examined using the Pearson correlation coefficient. Statistical significance was defined as a p-value< 0.05.

Results

Table 1 shows a comparison of kidney volume and estimated glomerular filtration rate (eGFR) between preterm and term infants at the corrected age of 12-18 months. The table includes two groups, preterm infants (n=120) and term infants (n=120), with their corresponding kidney volume and eGFR values. The mean kidney volume was significantly lower in preterm infants (25.7±5.8 mL) compared to term infants (30.5±6.5 mL) (p-value<0.001). Similarly, the mean eGFR was significantly lower in preterm infants (77.2±15.8 mL/min/1.73m2) compared to term infants (90.7±12.6 mL/min/1.73m2) (p-value<0.001).

Table 2 presents a comparison of urinary protein excretion and serum creatinine levels between preterm and term infants at the corrected age of 12-18 months. The table includes two groups, preterm infants (n=120) and term infants (n=120), with their corresponding urinary protein excretion and serum creatinine levels. The mean urinary protein excretion and serum creatinine levels were comparable between

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preterm infants (37.4±27.4 mg/dL and 0.48±0.09 mg/dL, respectively) and term infants (36.1±24.5 mg/dL and 0.47±0.07 mg/dL, respectively). The p-values for both comparisons were not statistically significant (p-value=0.72 for urinary protein excretion and p-value=0.53 for serum creatinine levels).

Table 3 illustrates the prevalence of hypertension in preterm and term infants at the corrected age of 12-18 months. The table includes two groups, preterm infants (n=120) and term infants (n=120), with the number and percentage of infants who had hypertension or no hypertension. Hypertension was defined as systolic or diastolic blood pressure above the 95th percentile for age, sex, and height. The table shows that the prevalence of hypertension was significantly higher in preterm infants (8.2%) compared to term infants (2.1%) (p-value<0.05).

Table 1: Comparison of kidney volume and eGFR values between preterm and term infants

Group	Kidney volume	eGFR
Preterm infants (n=120)	25.7±5.8	77.2±15.8
Term infants (n=120)	30.5±6.5	90.7±12.6
p-value	<0.001	<0.001

Table 2: Comparison of urinary protein excretion and serum creatinine levels between preterm and term infants.

Group	Urinary protein excretion	Serum creatinine
Preterm infants (n=120)	37.4±27.4	0.48±0.09
Term infants (n=120)	36.1±24.5	0.47±0.07
p-value	0.72	0.53

Table 3: Prevalence of hypertension in preterm and term infants

Group	Hypertension	No hypertension
Preterm infants (n=120)	10 (8.2%)	110 (91.8%)
Term infants (n=120)	2 (2.1%)	118 (97.9%)

Discussion

The current investigation discovered that, at corrected ages of 12 to 18 months, preterm infants had smaller kidney volumes and lower eGFR levels than term infants. This shows that preterm newborns may be more susceptible to chronic kidney disease and renal impairment as they age. This result is in line with other research that found that people who were born prematurely had a greater frequency of chronic renal disease [9–11].

The results of the current study are in line with earlier ones that have demonstrated that preterm children have shorter kidneys and smaller kidney volumes than term infants at birth, but that these differences are made up by the time they reach corrected adulthood at age 2 [12,13]. The surviving nephrons' compensatory hypertrophy, which increases the size and functionality of each individual nephron, is assumed to be the

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cause of the compensatory enlargement of the kidneys [14].

In line with earlier investigations [15,16], the current study also found a favourable connection between kidney volume and length and eGFR. The quantity and operation of nephrons affect eGFR, a measurement of total kidney function. The fact that kidney size and eGFR are positively correlated shows that larger kidneys have more nephrons and are better at filtering blood.

In line with earlier research [17,18], the mean serum creatinine and BUN levels in the current study population were within the normal range for age. It is crucial to keep in mind, though, that serum creatinine and BUN values might not be sensitive enough to identify early alterations in kidney function in preterm newborns. Additionally, it has been demonstrated that preterm infants with low birth weight have kidney function overestimated by the Schwartz formula used to calculate eGFR [19].

It is important to recognise that the current study has a number of limitations. First, the fact that only one centre was included in the study may limit how far the results may be applied. Second, the sample size was somewhat small, which might have reduced the study's ability to identify important changes. Thirdly, because longitudinal studies are required to assess the trajectory of renal development in preterm infants, the study only evaluated renal growth and function at a single time point.

Conclusion

In conclusion, the current study shown that preterm children have normal kidney length and volume at corrected ages of 12 to 18 months, and that there is a positive link between kidney size and eGFR. According to these results, preterm newborns experience renal compensatory development, and larger kidneys are linked to better overall kidney function. To better understand the course of renal development in preterm newborns and to find early signs of kidney disease, longitudinal studies are required.

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