

A STUDY TO PREDICT WEIGHT OF CHILDREN AGED UP TO 2 YEARS BASED ON FOOT LENGTH FOR EMERGENCY DRUG DOSAGE CALCULATION ON BASIS OF PREDICTED WEIGHT

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ABSTRACT

Background: Anthropometry is the science of measurement of human body and is important part of clinical examination. Foot length is an important the growth parameter.

Aims & Objectives: (1) To determine correlation between foot length, weight & length of child. (2) To compare drug dosage calculated as per predicted weight from foot length with those calculated on the basis of actual weight.

Materials and Methods: The study was a cross sectional study. After taking consent of the parents, 250 children age up to 2 years admitted in NICU and PICU during April 2008 to October 2008 were selected by purposive sampling. Information on anthropometric measurements like weight, Head circumference, height and foot length were collected and analyzed using appropriate software.

Results: Out of 250 children, 113 (45.2%) are 0-28 days, 87 (34.8%) are 29 days to 1 year, 48 (21%) are between 1 to 2 years of age. The scatter diagram demonstrate a significant correlation between foot length and weight ($r^2 = 0.948$; $p < 0.01$) and between foot length and length ($r^2 = 0.94$; $p < 0.01$). The weight of the child up to 2 years can be calculated by mathematical formula, using best fit regression line is $\text{weight} = -4.55 + [1.222 + \text{foot length in cm}]$. The dose calculated on the basis of predicted weight exceeded the standard dose up to $+2.48 - 2.50\%$ for drugs.

Conclusion: There is significant direct correlation between foot length and weight and also with length in child up to 2 years.

Key Words: Foot Length; Predicted Weight; Drug Dosage; Length of Child; Weight Formula

Introduction

Anthropometry is the science of measurement of human body and is important part of clinical examination.^[1] These measurements include weight, length/height, head circumference, chest circumference, mid upper arm circumference etc.^[2] Previous studies show that foot length is also one of the growth parameter like other. Fetal foot length is a reliable parameter of estimating a gestational age by ultrasonography.^[3] For neonate, foot length is a predictor of nasotracheal tube length and same has also statistically significant correlation with crown to heel length and weight for pre terms and full terms including low birth weight.^[4,5]

Newborns particularly preterm and infants require acute intensive care in majority of cases admitted to NICU and PICU. Here, the patient gets surrounded by doctors and paramedical staff for immediately begins process like, quick clinical evaluations, intravenous access, administrations of oxygen, endotracheal intubation etc. Under such circumstances it is not feasible to determine

child's weight, length or surface area. Yet the drug dosage and intravenous fluid requirements are to be worked out more accurately and precisely. Foot length measurement would be possible for even paramedical staff due to easy exposure, even in the premature babies and very sick infants.^[6] The calibre required is a small one and can be use easily.

The present study was conducted in NICU and PICU at general hospital Ahmedabad to find out correlation between foot length and weight & length of child and to find a formula for drug dosage calculation based on predicted weight of patient by measuring the foot length.

Materials and Methods

The study was a cross sectional study. After taking written and informed consent of the parents, 250 children age up to 2 years admitted in NICU and PICU during April 2008 to October 2008 were selected by purposive sampling. All children aged up to 2 years including pre terms and terms neonates were enrolled in

the study. Patient's age was determined on the basis of birth card or Mamta card or birth certificate. The complete sample of study was divided into 3 sub-groups according to age and as (1) From 0-28 days (2) From 29 days - 12 months and (3) From 12 months - 24 months. The details such as birth weight and gestational age at birth were recorded. Anthropometric measurements like weight, Head circumference, height and foot length were taken. Children with foot deformity were not included in this study. Weight was measured on electronic weight machine with accuracy of 10 gm. Scale was adjusted zero error before weight. Body length was measured by an infantometer with accuracy of 0.1 cm. Foot length was measured by Vernier calliper with accuracy of 0.01cm.

Statistical Analysis

After taking all measurements, the data was analyzed using linear regression analysis. Attempts were made to derive formula that would predict weight on the basis of foot length. The co-efficient of determination r^2 was calculated. Mean dosages of emergency medication (e.g. Epinephrine, Diazepam, Atropine) obtained from standard pediatric texts were used for comparison between doses calculated as per actual weight at those calculated on the basis of predicted weight.

Results

Table 1 shows age and sex wise distribution of children of the present study. Out of 250 children, majority children (55.8%) were in post neonatal period. Out of 250, 153 (61.3%) children were male. Scatter diagram in Figure 1 demonstrate a significant relationship between foot length and body weight ($r^2=0.948$; $p<0.01$). The coefficient of determination of 0.9482 indicates that 94 % of variability in weight might be explained by the linear regression model. So there is positive correlation between foot length and weight of child.

Scatter diagram in Figure 2 demonstrate a significant positive relationship between foot length and body length ($r^2=0.94$; $p<0.01$). By using best fit regression line between foot length and body weight as seen in figure 1 a mathematical formula was derived for a prediction of weight (kg) based on foot length (cm).

$$\text{Weight (kg)} = -4.55 + [1.222 \times \text{foot length (cm)}]$$

Where -4.55 is the constant.

Table 2 depicts the percentage variation of the emergency drugs, derived from weight predicted by using foot length. It was found that the dose of

administered on the basis of the actual weight of the child is similar to the dose that would be administered weight predicted on the basis of foot length were to be used. The dose calculated on the basis of predicted weight exceeded the standard doses +2.48-2.50% for the drugs studied.

Table-1: Age and Sex wise distribution of children of the present study

Age	Male	Female	Total	%
0-28 days	62	51	113	45.2
29 days - 1 Year	61	26	87	34.8
1 year - 2 years	30	18	48	21.0
Total	153	97	250	100.0

Table-2: Percentage variation of the certain emergency drugs derived from weight predicted using foot length

Drug	Standard Dose	Percent variation
Epinephrine (mg/kg)	0.01	2.48%
Diazepam (mg/kg)	0.2	2.48%
Ringer lactate (ml/kg)	20	2.50%
Atropine (mg/kg)	0.01	2.48 %

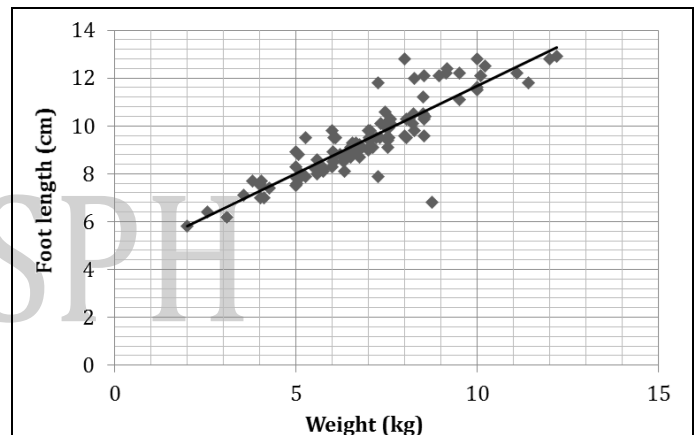


Figure-1: Graph depicting statistically significant linear relationship between weight and Foot length ($r^2 = 0.948$; $p<0.01$)

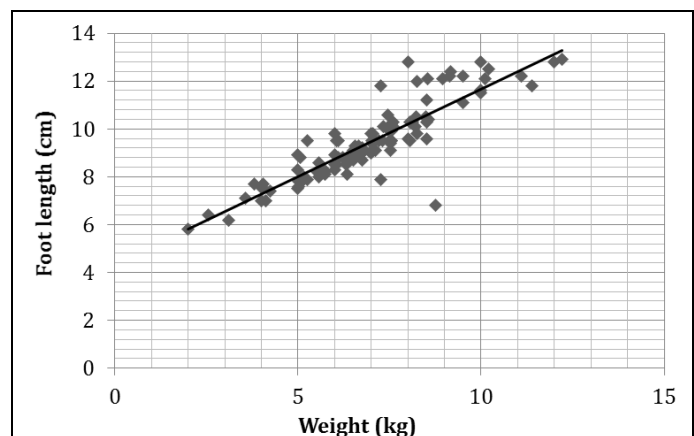


Figure-2: Graph depicting statistically significant linear relationship between foot length and length ($r^2 = 0.94$; $p<0.01$)

Discussion

Emergency in NICU and PICU are in various forms .In this condition resuscitation part should be more important

and should be lifesaving. But we are not able to take weight, length and body surface area, which are more important for drug dosage calculation, because sometimes patient is attached with ventilator and other monitoring device which make us difficult to take all these measurements. Most of the patient has come; do not have medical evidence that suggest previous weight. And patient of malnutrition also misguide us due to their clinical poor growth indicators.

Foot length measurement can be possible simultaneously with resuscitation due to easy exposure by using small Vernier calliper even easy for paramedical staff.

There is statistically significant direct correlation between foot length and weight ($r=0.94$), foot length and length ($r = 0.94$) in children aged up to 2 years. In studies of Bavdekar et al, James DK et al, Gohil Jayendra et al and Theodor B et al there is a significant co-relation between foot length & weight and foot length & length for children aged up to 2 years and also for school aged children.^[6,7,9,10]

In Patel S. M. et al significant correlation was observed between height and foot length.^[8] In Bavdekar et al the formula for prediction of weight is:
Weight (kg) = $-5.15 + [1.35 \times \text{foot length (cm)}]$

This difference might exist due to different age (our study includes preterm and terms neonate with low birth weight, nutrition pattern and environment, etc. In their study the dosage of the drugs calculated on the basis predicted weight vary from the doses calculated on the basis of actual weight by $+ 2.35 - 2.40\%$.

Conclusion

The study has derived statistically significant correlation between foot length, weight, length. There is definitely a need for well-planned, large-scale studies using standardized methodologies to determine correlation between foot length, weight & length of child so dosage of emergency drugs can be calculated in emergency using foot length. When planning these studies it is necessary to ensure that importance is given to accurate anthropometric measurement and representation from different region.

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