FOOTLENGTH MEASUREMENT AS AN EFFECTIVE TOOL IN IDENTIFICATION OF LOW BIRTH WEIGHT BABIES
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Abstract
The incident rates for LBW at term conservatively estimate IUGR because when all infants below the 10th percentile of the birth-weight-for-gestational-age reference are considered, approximately 24% or 30 million newborn in developing countries would be affected each year. Prematurity and IUGR are the two main cause of LBW. The majority of LBW in developing countries is due to IUGR, while most LBW in industrialized countries is due to preterm birth. The study was conducted on five hundred and fifty newborns of either sex. The newborns were taken from the Neonatal Intensive Care Unit (NICU) of Department of Pediatrics and those present in the post-natal and post-operative ward of Department of Obstetrics and Gynaecology, S.N. Medical College and Hospital. Neonatal and infant mortality rates are the sensitive indicators of child health. NMR of 37 for India and 44 per 1000 live births for UP is alarmingly high as compared to the other parts of the world. Of these neonatal deaths nearly 2/3 die within 1st week weak itself. LBW and prematurity contribute to a significant proportion of the cause.

Key Words: IUGR, NMR, LBW and Crown-heel length

1. INTRODUCTION:
Population-wide interventions aimed at prevention and improving infant health are urgently required.\(^1\)\(^2\) One of the nutritional goals of the 1990 World Summit for Children was to reduce the prevalence of low birth weight to less than 10% by the year 2000 – needless to say, this remains a formidable challenge for the 21st century.

Historically, because valid assessment of gestational age is often not available in developing countries, evidence of LBW has often been used as a proxy to quantify the magnitude of IUGR.\(^3\)\(^4\) The incident rates for LBW at term conservatively estimate IUGR because when all infants below the 10th percentile of the birth-weight-for-gestational-age reference are considered, approximately 24% or 30 million newborn in developing countries would be affected each year.\(^5\)

Prematurity and IUGR are the two main causes of LBW. The majority of LBW in developing countries is due to IUGR, while most LBW in industrialized countries is due to preterm birth.

To assess the cost effectiveness of preventive measures in LBW compared to expenses on management of complications arising out of LBW a study was conducted. The study concluded that the preventive measures to indentify LBW causes and its prompt referral reduces the cost on the individual and country as a whole.\(^6\)

2. EXPERIMENTAL METHODS:
2.1 ANTHROPOMETRIC MEASUREMENTS:
The study was conducted on five hundred and fifty newborns of either sex. The newborns were taken from the Neonatal Intensive Care Unit (NICU) of Department of Pediatrics and those present in the post-natal and post-operative ward of Department of Obstetrics and Gynaecology, S.N. Medical College and Hospital. Agra. The study was conducted from September 2005 to August 2007.

In India, a major chunk of the approximately 20 million births in rural areas, occur at home and are conducted by illiterate and often untrained traditional birth attendants (TBA).\(^9\) Provisions of valid weight scales of domiciliary level poses logistic (carrying a heavy scale), as well as, operational problems (inability of TBAs to read). Also, because of socio-cultural reasons, parents are reluctant to get their children weighed immediately after birth. So
there is a pressing need for an easy and rapid method to identify low birth weight babies in these rural areas.

2.2 ANTENATAL HISTORY:
1st Trimester:
- Fever
- Rash, vesicular or postural eruptions.
- Excessive vomiting
- Lymphadenopathy
- Medical illness
- Drug intake
- Injury

2nd Trimester:
- Antenatal visits if any
- Fever
- Iron & folic acid intake
- Hematological or radiological investigations.
- Fetal movements.
- Injury
- Weight gain

3rd Trimester:
- Duration of labour
- Mode of delivery
- Prolonged or obstructed labour
- Excessive bleeding
- Fetal outcome

2.3 PHYSICAL EXAMINATION OF THE NEWBORN:
2.3.1 General:
- Apgar score
- Skull and facial symmetry
- Cephalhematoma or succedaneum
- Examination of anterior fontanelle, sutures and posterior fontanelle.
- Oral cavity, eyes and ears.
- Skin and mucus membrane including colour.
- Spine and vertebra.
- Anal orifice.
- Neonatal reflexes mainly Moro’s, rooting sucking, swallowing and symmetric tonic neck reflex.
- Any congenital malformation.
- Edema, cyanosis, icerus, pallor, sings of respiratory distress.
- Ballard scoring to confirm gestational age.
- Examination of umbilical cord.

2.4 ANTHROPOMETRIC EXAMINATION:
2.4.1 Crown-heel length:
Recorded on an infantometer. Neonate was placed supine on infantometer. Assistant or mother was asked to keep the vertex simply touching the fixed vertical plank. The legs fully extend by pressing at the knees and feet kept vertical at 90°, the movable pedalplank was snugly apposed against the sole and recorded from the scale.

2.4.2 Occipito frontal circumference:
Measure with a non-stretchable fiber glass tape encircling over the most prominent part of occiput and supra orbital frontal areas with accuracy of 0.1 cm, a minimum of three observations was recorded.

2.4.3 Chest circumference:
Measures at the level of nipples with a steel tape.

2.4.4 Midarm circumference:
Recorded with a steel tape at the mid-point between acromion and olecranon with an accuracy of 0.1 cm.

2.5 STATISTICAL ANALYSIS:
The statistical tests applied were:
- Pearson’s coefficient of correlation
- Combination matrix
- Regression analysis
- Paired ‘t’ test
- Chi-square test

The statistical analysis was carried out by using SPSS version 12.1 for windows.

3. RESULT AND DISCUSSION:
3.1 Observations:
The present study was conducted in the Department of Pediatrics, S.N. Medical College & Hospital, Agra. Five hundred and fifty newborn of either sex were studied. Anthropometric measurements including birth weight and foot-length was recorded on all the newborns within 24 hours of delivery. The study group newborns comprised a majority i.e. 464 (84.37%) terms babies and only 86 (15.6%) were preterm.

Table 1: Distribution of cases according to crown heel length

| Crown heel length (cm.) | No. of cases (n) | Percentage (%) |
|-------------------------|-----------------|----------------|
| <38                     | 23              | 4.18           |
| 38-42                   | 87              | 15.82          |
| 42-46                   | 154             | 28.18          |
| 46-50                   | 251             | 45.45          |
| >50                     | 35              | 6.36           |
| **Total**               | **550**         | **100**        |
| Mean ± SD               | **47.4 ± 1.86** |                |
The above table illustrates distribution of cases according to crown heel length. 251 (45.45%) cases had a crown heel length of 46-50 cms, 154 (28.18%) cases between in 42-46 cms, 87 (15.82%) a CHL of 38-42 cm. Only 35 (6.36%) cases had a CHL of < 50 cm followed by 23 (4.18%) with a CHL of < 38 cm. The mean CHL was 47.4 ± 1.86 cm.

Table 2: Distribution of cases according to occipito frontal circumference (OFC)

| OFC (cms) | No. of cases (n) | Percentage (%) |
|-----------|------------------|----------------|
| < 25      | 6                | 1.09           |
| 25-28     | 67               | 12.18          |
| 28-31     | 170              | 30.91          |
| 31-35     | 246              | 44.73          |
| > 35      | 61               | 11.09          |
| Total     | 550              | 100            |
| Mean ± SD | 33.26 ± 1.28     |                |

Table-2 is a representation of cases according occipito frontal circumference (OFC). Maximum cases 246 (44.73%) had a OFC between 31.35 cms, 170 (30.91%) cases had a circumference of 28-31 cms, while only 61 (11%) cases had a circumference of > 35 cms. Mean OFC :33.26 ± 1.28 cm.

The above table shows distribution of cases according to chest circumference. Most of all cases 281 (51.09%) had a CC between 30-33 cms, followed by 140 (25.45%) cases with a chest circumference of 27-30 cms. 106 (19.27) cases a CC of 24-27 cm, 17 (3.09%) CC of < 24 cms. The mean CC was 31.08 ± 1.64 cm.

Table 3: Distribution of cases according to chest circumference (CC)

| CC (cms) | No. of cases (n) | Percentage (%) |
|----------|------------------|----------------|
| <24      | 6                | 1.09           |
| 24-27    | 106              | 19.27          |
| 27-30    | 140              | 25.45          |
| 30-33    | 281              | 51.09          |
| >33      | 17               | 3.09           |
| Total    | 550              | 100            |
| Mean ± SD| 31.08 ± 1.64     |                |

The above table illustrates the newborns according to their mid-arm circumference. 295 cases (53.64%) with MAC of 8-9 cm. Represented the maximum share while 172 (31.27%) cases had a MAC of 7-8 cm, only 24 (4.36%) had a MAC of >10 cm. The mean MAC was 8.7 ± 0.4 cm.

Table 5: Predictions of birth weight below2500G using the foot length

| Parameters | Birth Weights | <7.3 cm | <7.35 cm | <7.4 cm |
|------------|---------------|---------|----------|---------|
| Sensitivity (%) | 72.5 (CI=64.1-79.6) | 70.6 (CI=62.8-77.4) | 64.8 (CI=51.2-71.7) |
| Specificity (%) | 97.0 (CI=95.5-98.0) | 98.5 (CI=97.3-99.1) | 98.5 (CI=97.4-99.2) |
| +ve Predictive (%) | 79.4 (CI=71-85.8) | 89.7 (CI=82.7-94.2) | 90.5 (CI=83.6-94.8) |
| -ve Predictive (%) | 95.7 (CI=94-96.9) | 94.6 (CI=92.9-96.0) | 92.9 (CI=90.9-94.5) |

CI: Correlation Index

The sensitivity, specificity and positive predictive value for foot length less than 7.3 cm were 72.5%, 97% and 79.4% respectively. For foot length less than 7.35 cm, sensitivity was lower but specificity and positive predictive value were higher. The positive predictive value was highest at the cut-off point of 7.4 cm.

4. SUMMARY AND CONCLUSION:

Neonatal and infant mortality rates are the sensitive indicators of child health. NMR of 37 for India and 44 per 1000 live births for UP are alarming high as compared to the other parts of the world of these neonatal deaths nearly 2/3 die within 1st week itself. LBW and prematurity contribute to a significant promotion of the cause.

Birth weight is an important indicator of child survival and is not only an indicator of health and nutritional status of the newborn and mother but it also reflects socio-economic status of the community as well as the country. Growth parameters assessed by the anthropometric measurements are the most accurate measurers to assess child growth. 75-80% of India population reside in rural areas with a majority of deliveries being conducted at home by traditional birth attendants (TBAs), untrained and other personals available in the family and vicinity. Thus in these settings, to identify high risk babies especially LBW babies need simple screening tool.
REFERENCES:

1. Mostly WH, Chen LC. An analytical framework for the study of child survival in developing countries. Bull World Health Org. 2003; 81(2): 140-145.

2. World Health Organisation. The Incidence of LBW: A critical review of available information. World health Stat Q. 1980; 197-204.

3. World Health Organization. Public health aspects of low birth weight: Expert Committee on Maternal and Child health. Technical Report Series 1981; 217.

4. Glozal D, Ndombo PK, ZeMinkande J, kago I, Ekpe T, Mbebe J. Anthropometric measurements in newborn population in West Africa. A reliable and simple tool for the identification of infants at risk for early postnatal morbidity. J Paediatr. 1991; 118: 800-5.

5. Goldenbreg RL, Cliver SP, Cutter GR, Hoffman HJ, Cassidy G, Davies RO, Nelson KG. Black-white difference in newborn anthropometric measurements. Obstetrics & Gynecology. 1991; 78: 782-788.

6. Pokhrel RP. Birth weight in relation to the gestational age at TUTH. Journal of Institute of Medicine. 1991;13:236-242.

7. Sharma JN, Saxena S, Sharma U. Relationship between birth weight and other neonatal anthropometric parameters. Indian Pedriatrics. 1988; 25:244-248.

8. Kulkarni MI, Rajendran NK. Values for foot length in newborns. Indian Pediatrics. 1992; 29(4):507-509.

9. Madhulika, Kabra SK, Barar V, Purohit A, Saxena S, Sharma U, Bansal RK. Upper and lower limb standards in newborns. Indian Pediatrics. 1989; 26(7): 667-670.