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COMPARISON OF THE FENTON AND INTERGROWTH 21 GROWTH CHARTS IN PRETERM BABIES TO ASSESS INTRAUTERINE GROWTH AND EXTRAUTERINE GROWTH.

Paediatrics

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ABSTRACT

Objectives: Comparison of the fenton and intergrowth 21 growth charts in preterm babies to assess intrauterine grow that birth and extrauterine growth. **Materials and Methodology:** Preterm infants born alive before 37 weeks of gestation and admitted at tertiary centre were included. Data on weight, length, and head circumference were recorded at birth, weekly until 40 weeks of gestational age, and on follow up in cases of discharge before 40 weeks. Variables such as maternal history, delivery methods, and hospital stay were also collected. Anthropometric measurements were done using digital baby scales and measuring tapes. **Results:** Intergrowth 21 charts detected a significantly greater number of newborns with IUGR compared to fentons ($p<0.05$). Fentons charts detected a significantly greater number of newborns with EUGR compared to Intergrowth charts ($p<0.05$). Maternal factors like the presence of maternal co-morbidities, intake of antenatal steroids, and mode of delivery being LSCS were significantly associated with EUGR ($p<0.05$). Neonatal factors like intubation, surfactant, presence of sepsis and hypoglycemia, use of TPN, fortification, and ROP were significantly associated with EUGR ($p<0.05$). **Conclusion:** Intergrowth-21st standards help in better detection of IUGR at birth and also preventing misclassification of newborns into postnatal growth restriction category at the time of discharge which may help in in-hospital and post-discharge nutrition plans.

KEYWORDS

Growth charts, Fentons growth chart, Inter growth 21 growth charts, Intrauterine growth restriction, Extra uterine growth restriction, Neonatal intensive care unit.

INTRODUCTION

Prematurity is becoming more common, especially with the improvement of artificial fertilization techniques.[1] In 2016, the Centers for Disease Control and Prevention (CDC) stated that one out of every 10 newborns was born prematurely. [2]

Newborn growth is an important indicator and screening strategy for a number of disorders or impairments that must be tracked using growth charts. Several charts have been established, the most of which are based on intrauterine growth and are rarely modified for premature babies. [3].

The Fenton chart is regarded as one of the best charts for measuring longitudinal growth in newborns aged 36 to 50 weeks, uncorrected.[4]

The Intergrowth 21 research resulted in a successful growth chart that is used to define criteria for the postnatal growth of premature infants. The Intergrowth-21 growth standards, like the World Health Organization (WHO) growth standards, aim to develop graphs that show ideal rather than average growth and can be used globally.[4]

The purpose of this study was to evaluate the fenton chart and Intergrowth-21 charts in terms of extra- and intra-uterine growth restriction, as evidenced by weight, height, and head circumference at birth, and to identify risk variables associated with extrauterine growth restriction.

Aims and Objectives

To compare fenton and intergrowth 21 growth charts in preterm babies to assess intrauterine growth and extrauterine growth.

MATERIALS AND METHODS

The study was Prospective study conducted on 105 preterm babies admitted in Raja Rajeswari Tertiary Care hospital over a period of 18 months. Cases were selected based on inclusion and exclusion criteria.

Inclusion Criteria

All preterm infants born alive before 37 weeks of gestation and admitted at Raja Rajeswari Tertiary Care hospital were included in the study.

Exclusion Criteria

All the babies born at > 37 weeks of gestation or <24 weeks will be excluded, Preterm babies who die during hospitalization, Preterm Babies having any major congenital abnormality.

Ethical Committee approval & and informed consent was obtained

Weight, length and head circumference of each preterm newborn at birth, every week till 40 weeks of corrected gestational age/till baby is in hospital was noted, and then was marked on the percentile curves of the Fenton 2013 and Intergrowth 21 charts. In case, the newborn was discharged before 40 weeks, anthropometry was noted and plotted on follow upto high-risk clinic.

The data on other variables such as, Doppler changes in antenatal scan, maternal history, any co morbidity in the mother, delivery methods, date of birth of the new born, newborn details, the need for intubation, surfactant replacement therapy, any blood transfusion, use of total parenteral nutrition, time of starting feeds, time of reaching full feeds, and the length of stay at the hospital was also collected.

Anthropometric Measurement

Weight and height were measured using a digital baby scale with a rod, whereas head circumference was obtained via a measuring tape.

Statistical Analysis

All the data was entered in excel and sent to statistical analysis.

RESULTS

The majority were males i.e., 56 (53.3%), majority were gravid 1 i.e., 39 (37.1%) & para 1 i.e., 85 (81%). The majority had Gestational HTN i.e., 17. Majority underwent LSCS i.e.,80 (76%)

In the present study, Intergrowth 21 charts detected significantly greater number of newborns (7) with IUGR compared to fentons ($p<0.05$).

At 1st week, significant difference was found between fenton / inter growth 21growth charts with a significantly greater number of newborns with length <3rd centile & HC <3rd centile on intergrowth 21 charts at 1st week ($p<0.05$).

At 2nd week, A significant difference was found between fenton / inter growth 21 growth charts with a significantly greater number of newborns with weight between 10 to 90th centile & HC <3rd centile & HC between 10 to 90th centile on intergrowth 21 charts at the 2nd week ($p<0.05$)

At 3rd week, No significant difference was found between fenton v/s intergrowth 21 growth charts in the interpretation of weight at 3rd week ($p<0.05$). A significant difference was found with a significantly greater number of newborns with length <3rd centile & HC <3rd centile

on intergrowth 21 charts at 3rd week (p<0.05).

At 4th week, A significant difference was found with a significantly greater number of newborns with weight <3rd centile on fentons charts at the 4th week (p<0.05).

Whereas, A significant difference was found with a significantly greater number of newborns with length <3rd centile & HC <3rd centile on intergrowth 21 charts at 4th week (p<0.05).

In the present study, 94 newborns were found to have EUGR on fentons compared to 69 on intergrowth. 68 (73%) had EUGR on both the charts, and 52 (98%) were normal on both the charts. There was a significant difference in the detection of EUGR between the charts with a significantly greater number of EUGR newborns on fentons compared to Intergrowth (p<0.05).

Table 1: Comparison of EUGR at Discharge on Fentons and Intergrowth Charts

EUGRON FENTONS		EUGRON INTERGROWTH		TOTAL	PVALUE
		YES	NO		
YES	N	68	26	94	<0.00001.*
	%	73%	27%	100.0%	
NO	N	1	52	53	
	%	2.0%	98.0%	100.0%	
TOTAL	N	69	42	105	
	%	63.0%	37.9%	100.0%	

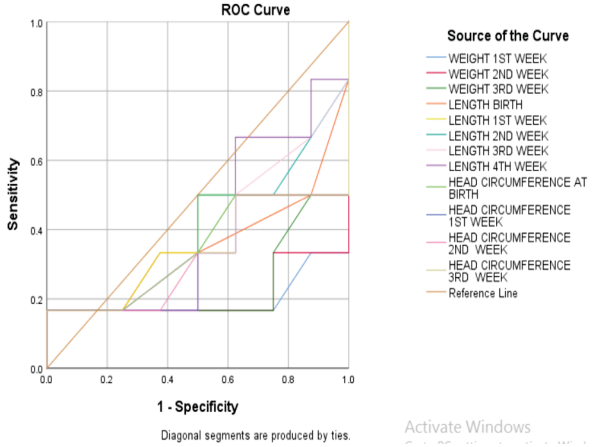
Maternal factors like presence of maternal co-morbidities, intake of antenatal steroids and mode of delivery being LSCS were significantly associated with EUGR (p<0.05). Whereas maternal factors like higher parity and gravida were not significantly associated with EUGR (p<0.05).

Neonatal factors like intubation, surfactant, presence of sepsis and hypoglycaemia, use of TPN, fortification and ROP were significantly associated with EUGR (p<0.05).

On regression analysis, factors like maternal co morbidity, and intubation, were found to be significant independent predictors of IUGR on both the charts. In addition, sepsis and ROP were found to be significant predictors of IUGR on Fenton and hypoglycemia was found to be significant predictors of IUGR on Intergrowth 21 charts. EUGR on inter growth 21charts- R^2 0.103 IUGR on fentons charts -R^2 0.121 INTERGROWTH 21 is superior to FENTONS in the detection of IUGR.

On regression analysis, factors like maternal comorbidity, intubation, and sepsis were found to be significant independent predictors of EUGR on both charts. In addition to it, ROP was found to be a significant predictor of EUGR on Fenton. EUGR ON INTER-GROWTH CHARTS-$R^2$0.057 EUGR ON FENTONS CHARTS -R^2 0.059. Fentons are superior to inter growth 21 in the detection of EUGR.

The AUC for intergrowth21 charts was highest for weight at birth(1.20), length at birth (1.396) and for HC at birth (1.344).



Graph 1: ROC Curve for Intergrowth 21 Chart

DISCUSSION

This study was conducted among preterm babies admitted to the Neonatal Intensive Care Unit at Raja Rajeswari Tertiary Care hospital to compare fenton and intergrowth 21 charts and to assess the risk factors associated with EUGR.

The majority i.e., 56 (53.3%) were males and 49 (46.7%) were females. The mean (standard deviation [SD]) gestational age at birth among preterm newborns in this study was 34.65(2.024) weeks. The mean birth weight in this study was 2.2073±0.55472kg.

Majority i.e.,39 (37.1%) were gravid 1, Whereas in a study by Jakubowski et al.[5] majority were gravida 2-4. The majority i.e., 85 (81%) were para 1.

In this study, the majority i.e., 17 (16%) had Gestational HTN similar to a study by Barreto et al.[6]. In this study, the majority i.e., 80 (76%) underwent LSCS similar to a study by Jakubowski et al.[5]

In this study, the mean APGAR score in 1st minute was 7.45±0.759, and in 5th minute was 8.64±0.709 which is almost similar to study by Barreto et al[6]

Comparison of IUGR between IG and Fentons: In this study, Intergrowth 21 charts detected a significantly greater number of newborns (7) with IUGR compared to fentons (p<0.05). In accordance to present study, Tuzunetal.[7] found IUGR rate was significantly higher (12versus15%, p=.004) with the Intergrowth-21st charts compared with the Fentons. In consistent with this study, Haridas et al.[8] noted fenton v/s intergrowth for IUGR among preterm newborns was 13.5% and 15.2%.

In contrary to present study, Patel et al[9] &overall, Fenton reported more IUGR compared to Intergrowth 21 charts (42.9% vs 36.9%)

Comparison of EUGR between IG and Fentons: In this study, 94 newborns were found to have EUGR on fentons compared to 69 on intergrowth. There was a significant difference in the detection of EUGR between the charts with a significantly greater number of EUGR newborns on fentons compared to Intergrowth (p<0.05). These excess 25 newborns detected as EUGR on fentons were found to be normal on intergrowth 21 charts. In a study by Tuzun et al [7] EUGR rate was significantly lower (40.2 versus 31.5%, p<.001) with the Intergrowth-21st charts compared with the Fentons which was similar to this study.

In a study by Lan et al. [10]The IG-21 curves diagnosed more newborns with EUGR compared to Fentons (19% vs. 14.7%). This was contrary to the present study.

Comparison of length at 1st week

A significant difference was found between fenton v/s intergrowth 21 growth charts with a significantly greater number of newborns with length <3rd centile on intergrowth 21 charts at 1st week (p<0.05). Similar results were seen in Barreto et al.[6] Haridas et al.[8]

At 1st week, a significant difference was found between fenton v/s intergrowth 21 growth charts with a significantly greater number of newborns with HC <3rd centile on intergrowth 21 charts at 1st week (p<0.05). In a study by Barreto et al.[6] HC <10th centile was less on intergrowth compared to Fentons which was contrary to this study.

In a study by Lan et al.[10] The IG-21 curves diagnosed more newborns with EUGR compared to Fentons (19% vs. 14.7%). This was contrary to the present study.

2nd week

Significantly greater number of newborns with weight at <3rd centile and between 10 to 90th centile on intergrowth 21 charts at 2nd week were detected compared to fentons (p<0.05) and a significantly greater number of newborns with length and HC <3rd centile on intergrowth 21 charts (p<0.05). In a study by Samarani et al.[3] when considering the weight and height at 2 weeks, the results showed that the Intergrowth 21 scale would predict those variables better than the Fenton scale which was consistent with this study.

3rd week

No significant difference was found between fenton v/s intergrowth 21 growth charts in the interpretation of weight at 3rd week (p<0.05). A

significant difference was found between fenton v/s intergrowth 21 growth charts with a significantly greater number of newborns with length and HC <3rd centile on intergrowth 21 charts (p<0.05).

4thweek

A significant difference was found between fenton v/s intergrowth 21 growth charts with a significantly greater number of newborns with weight <3rd centile & greater number of newborns with length and HC <3rd centile on fentons charts at the 4th week (p<0.05).

In a study by Samarani et al.[3] at 4 weeks, the results showed that the Fenton scale predicted weight (R2 = 0.655 vs 0.631) and height (R2 = 0.710 vs 0.643) better than the Intergrowth 21 scale. This finding was similar to this study concerning weight but contrary to height.

Association between maternal factors and EUGR: Maternal factors like the presence of maternal co-morbidities, intake of antenatal steroids, and mode of delivery being LSCS were significantly associated with EUGR (p<0.05). Whereas maternal factors like higher parity and gravida were not significantly associated with EUGR (p<0.05).Whereas in a study by Samarani et al.[3] LSCS was not a significant predictor of EUGR which was contrary to this study.

Association between neonatal factors and EUGR: Neonatal factors like intubation, surfactant, presence of sepsis and hypoglycemia, use of TPN, fortification, and ROP were significantly associated with EUGR (p<0.05). In a study by Samarani et al.[3] intubation was a significant predictor of EUGR which was similar to this study but gender being a significant predictor of EUGR in their study was contrary to the present study

Limitations

Limited sample size, socioeconomic status and environmental influences were not fully accounted for in the analysis, The accuracy and precision of these measurement tools may vary, influencing the study's conclusions, Longer follow-up would be necessary

CONCLUSION

The INTERGROWTH-21st standards aid in the diagnosis of IUGR at birth as well as the prevention of newborns being misclassified as having postnatal growth restriction at the time of discharge, which may aid in in-hospital and post-discharge feeding regimens. However, further research needs be done to determine the functional significance of these variances on long-term outcomes such as neurologic and cardiometabolic morbidities.

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