ORIGINAL ARTICLE

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.

https://doi.org/10.22037/orlfps.v7i1.34600

Measuring Head Circumference in Neonates Weighing Less Than 2500 Grams

Farzam Roshanali[1], Mohammad Amin Abdollahifar[2], Reza Mastery Farahani[2], Mohammad Mahdi Nazarnejad[3*]

1. School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2.Department of Biology and Anatomical Sciences, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
3. Department of Anatomical Sciences & Cognitive Neuroscience, Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

Article Info

Article Note:
Received: April, 2021
Accepted: June, 2021
Publish Online: July, 2021

Corresponding Author:
Mr. Mohammad Mahdi Nazarnejad

Email:
nazarnejad2001@gmail.com

Keywords:
Neonates;
LBW;
Head circumference.

Abstract

Background: Anthropometric measures are important research goals especially because of racial differences and also variation in measurement techniques. In this study, head circumference in neonates weighing less than 2500 grams in Emam-Hosein hospital in 2018 was assessed.

Aim: The aim of this study was to measuring head circumference in neonates weighing less than 2500 grams.

Methods: In this cross-sectional study, 200 neonates weighing less than 2500 grams in Emam-Hosein hospital in 2018 were enrolled. The head circumference in neonates was determined and also was compared according to gestational age, birth weight, and sex.

Results: There were 53% males and 47% females. There were 85.5% preterm neonates. Birth weight was less than 2000 gram in 12.5%. Head circumference was low in 148 cases (74%). The head circumference was not differed by gestational age, birth weight, and sex ($p > 0.05$).

Conclusion: Totally, it may be concluded that head circumference is normal only in ¼ of neonates weighing less than 2500 grams and it is not an optimal goal for growth pattern monitoring.

Conflicts of Interest: The Authors declare no conflicts of interest.
Please cite this article as: Roshanali F, Abdollahifar MA, Mastery Farahani R, Nazarnejad MM. Measuring Head Circumference in Neonates Weighing Less Than 2500 Grams. J Otorhinolaryngol Facial Plast Surg 2021;7(1):1-7. https://doi.org/10.22037/orlfps.v7i1.34600

Introduction

Head circumference measurement is defined as head circumference measurement is determined from the most protruding part of the occipital bone (occipital ridge) to the most protruding part of the frontal bone (distance between two eyebrow arches), the normal value of which is 32 cm up to 38 cm (1-3). Determining head circumference in addition to providing information on the quality of intrauterine life. Head circumference is also important for monitoring infant growth.. Infancy is important as we provide a diagram of head circumference and months of baby life and head circumference growth. Any abnormal changes can be checked and tracked (4-6). Head growth is such that in the first year of life on average 1 cm per month; in the first 3 months 2 cm per month and then slower, and 10 cm for the rest of life (7). It is noteworthy that in addition to head circumference, the child's weight and height are also assessed, which in case of disorders such as

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.
https://doi.org/10.22037/orlfps.v7i1.34600

malnutrition, first the weight and finally the head circumference is affected, so the monitoring of any deterioration during growth should be thoroughly evaluated (8-10). The purpose of measuring head circumference is summarized to: evaluation of intrauterine growth of the infant during the fetal period (11-13), and Examination for congenital disorders at birth (14-15).

It has been showed that the head circumference can help manage the child's growth and prevent complications. For example, in many diseases, the infant's head circumference is less or more than the normal range, which can be recognized and the necessary interventions in that disease can be performed. Due to the mentioned reasons, it is important to measure the infant's head circumference for relevant examinations and to reduce complications (16).

The study aims to find responses to the following questions: what diseases and disorders can it cause? Can screening or prevention of complications or disorders be applied according to the size of the baby's head circumference? Is there a relationship between head circumference and other vital parameters of the infant?

Methods

A cross-sectional study was carried out in Emam Hossein Hospital, Tehran in 2018. All consecutive full-term, singleton, live born infants were included. To ensure reliability and avoid inter-observer bias one of the investigators weighed all the newborns and carried out anthropometric measurements within 24 hours after birth. Head circumference of was measured according to standard techniques.

The cut-points with lowest total misclassification rate were chosen to identify LBW babies. Weight and head circumference were measured in 2695 infants in Emam Hossein Hospital at 37–41 completed weeks of gestation Weight was measured by digital scale and head circumference by firm plastic tape measures. Means and 95% confidence intervals were compared among newborns grouped by ethnicity and sex.

In this observational study the articles were first reviewed using PubMed and Google scholar resources. Then, the number of neonates was determined. In the next step, with face-to-face explanation and justification of mothers and obtaining written consent according to the relevant protocols and measuring instruments such as meters and scales, the baby's head circumference and baby's weight were examined and then the data were analyzed with statistics software, Bio-processed.

To implement this plan, the subjects, including mothers and infants, were studied as a general group without being divided into case-control groups. They were followed up within the framework of standard neonatal care and no intervention was made for this study. In addition to the mentioned issue, concealment of patients' personal characteristics was also considered due to observing the ethical considerations of the research. Observation and checklist were used to collect data. Explaining in a face to face manner and justifying the mothers and obtaining written consent, according to the relevant protocols for measuring the head circumference and weight of the baby, the mother was questioned and If the face-to-face access with the mother was not possible, the contents of the file were used and then the baby was examined and then the data was processed with software and discussed and concluded.

Finally, after collecting the required information from all subjects, who included 200 participants, we analyzed the data, in which we used the statistical software SPSS version 25.

Mean and standard deviation statistics were used to report quantitative variables in this study, and frequency and frequency percentage were used for qualitative cases. In this study,

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.
https://doi.org/10.22037/orlfps.v7i1.34600

analytical analysis included Chi-square and Fisher tests and the significance level was considered 0.05.

Results

Overall, based on the results obtained in this study, it is inferred that the circumference of infants born weighing less than 2500 gram is normal in only a quarter of cases and therefore is not a reliable factor in determining the presence of growth disorders in infants. It can also be said that there is no significant relationship between weights less than 2 grams and head circumference less than 2 cm with disorders such as microcephaly.

There is also no significant relationship between the sex of infants and the size of their head circumference with disorders such as microcephaly or hydrocephalus.

Finally, further studies are suggested to confirm the findings obtained in this study with the neonates size with weight and also to compare with other anthropometric indices of infants to achieve more definite results and proper planning. The findings are presented in Tables 1 to 7.

Table 1. Gender frequency distribution of the studied neonates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	106	53.0	53.0	53.0
	Female	94	47.0	47.0	100.0
	Total	200	100.0	100.0	

Table 2. Frequency distribution of gestational age of the studied neonates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Preterm	171	85.5	85.5	85.5
	Term	29	14.5	14.5	100.0
	Total	200	100.0	100.0	

Table 3. Frequency distribution of birth weight of the studied neonates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<2000	25	12.5	12.5	12.5
	2000-2500	175	87.5	87.5	100.0
	Total	200	100.0	100.0	

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.

https://doi.org/10.22037/orlfps.v7i1.34600

Table 4. Frequency distribution around the heads of the studied neonates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	148	74.0	74.0	74.0
	NL	52	26.0	26.0	100.0
	Total	200	100.0	100.0	

Table 5. Frequency distribution of head circumference based on the sex of the neonates

			HC		
			Low	NL	Total
Sex	Male	Count	79	27	106
		% within Sex	74.5%	25.5%	100.0%
	Female	Count	69	25	94
		% within Sex	73.4%	26.6%	100.0%
Total		Count	148	52	200
		% within Sex	74.0%	26.0%	100.0%

There was no statistically significant difference in the frequency distribution of head circumference based on the sex of the neonates ($p > 0.05$).

Table 6. Frequency distribution of head circumference based on gestational age of the studied neonates

			HC		
			Low	NL	Total
GA	Preterm	Count	128	43	171
		% within GA	74.9%	25.1%	100.0%
	Term	Count	20	9	29
		% within GA	69.0%	31.0%	100.0%
Total		Count	148	52	200
		% within GA	74.0%	26.0%	100.0%

There was no statistically significant difference in the frequency distribution of head circumference based on gestational age in the studied neonates ($p > 0.05$).

Table 7. Frequency distribution of head circumference based on birth weight of the studied neonates

			HC		
			Low	NL	Total
Weight	<2000	Count	19	6	25
		% within Weight	76.0%	24.0%	100.0%
	2000-2500	Count	129	46	175
		% within Weight	73.7%	26.3%	100.0%
Total		Count	148	52	200
		% within Weight	74.0%	26.0%	100.0%

There was no statistically significant difference in head frequency distribution based on birth weight of the neonates ($p > 0.05$).

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.
https://doi.org/10.22037/orlfps.v7i1.34600

Discussion

Anthropometric measurements are one of the goals of neonatal research, which shows differences in different populations, especially due to racial differences and criteria used. Therefore, this study was conducted to measure the head circumference of infants born in Imam Hossein (AS) Hospital with a weight of less than 2500 grams in 1397. In this cross-sectional study, 200 infants born in Imam Hossein (AS) Hospital weighing less than 2500 g in 1397 were examined and neonatal head circumference was measured based on gender, gestational age and birth weight they were compared. In this study, the neonates were 53% male and 47% female. Gestational age of the neonates showed that 85.5% were preterm. Birth weight of the neonates was less than 2000 g in 12.5% and between 2000 and 2500 g in 87.5%. The head circumference of the studied neonates was low in 148 cases (74%) and normal in other cases. There was no statistically significant difference in neonatal head circumference based on gender, gestational age and birth weight in infants. In 2006, Jennifer Peterson et al examined the head circumference of very low birth weight infants and disorders developed during school and found an association between reduced head circumference and brain disorders, including poor performance (17).

Of course, in our study, we did not have the possibility of long-term follow-up of infants in terms of intelligence and academic performance, but it could be a suitable and interesting topic for future research. In one analytical study, Anna et al (1999), examined the relationship between head circumference and brain volume, and the relationship between head circumference reduction and overall brain volume reduction, and vice versa (18). This highlights the importance of anthropometric studies in identifying children who may be further disabled, and highlights the need for further research. In 2003, Katz et al. examined the size of the infant' head circumference and weight and its association with rhinitis, asthma and eczema during adolescence in the United Kingdom, and found an association between the patient's head circumference and weight and related diseases (19). However, in our study, because the birth weight of infants were limited to only 2500 g, no statistically significant relationship was found in this case. In 2015, Susan et al. examined the measurement of neonatal head circumference and neonatal fetal age and the development of microcephaly, and found a correlation between them (20). But in our study, because the majority of infants were preterm, there was no statistically significant relationship. In 2008, Roth et al. Studied the size of the infant's head circumference and the development of oxidative metabolism in the brain with the consequences of neurodevelopment, and the relationship between them was observed which can be considered in future studies on Iranian children (21-22).

Conclusion

Overall, based on the results obtained in this study, it is concluded that the head circumference of infants born weighing less than 2500 g is normal in only a quarter of cases and therefore is not a reliable factor to determine the presence of growth disorders in infants. Finally, further studies are suggested to be done to confirm the findings obtained in this study. Those studies can work with a higher sample size and also to compare with other anthropometric indicators of neonates to achieve more definite results and appropriate planning to improve the prognosis of low birth weight infants.

Acknowledgments

Not declared.

Conflicts of Interest

The authors declare no conflicts of interest.

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.

https://doi.org/10.22037/orlfps.v7i1.34600

Financial Support

The authors declare there was no financial support.

Ethics

IR.SBMU.MSP.REC.1397.722

ORCID ID

Dr.Mohammad Amin Abdollahifar

https://orcid.org/0000-0001-6947-3285

Dr.Reza Mastery Farahani

https://orcid.org/0000-0002-3037-4236

Mohammad Mahdi Nazarnejad

https://orcid.org/0000-0002-3131-805X

References

1. Jennifer Peterson, H Gerry Taylor, NoriMinich, Nancy Klein, Maureen Hack, Subnormal head circumference in very low birth weight children: Neonatal correlates and school-age consequences. Edition 20,2016 Nelson Textbook of Pediatrics.

2. Lindley AA, Benson JE, Grimes C, Cole III TM, Herman AA. The relationship in neonates between clinically measured head circumference and brain volume estimated from head CT-scans. Early human development. 1999 Sep 1;56(1):17-29.

3. Katz KA, Pocock SJ, Strachan DP. Neonatal head circumference, neonatal weight, and risk of hayfever, asthma and eczema in a large cohort of adolescents from Sheffield, England. Clinical & Experimental Allergy. 2003 Jun;33(6):737-45.

4. Roth SC, Edwards AD, Cady EB, Delpy DT, Wyatt JS, Azzopardi D, Baudin J, Townsend J, Stewart AL, Reynolds EO. Relation between cerebral oxidative metabolism following birth asphyxia, and neurodevelopmental outcome and brain growth at one year. Developmental Medicine & Child Neurology. 1992 Apr;34(4):285-95.

5. Harris SR. Measuring head circumference: update on infant microcephaly. Canadian Family Physician. 2015 Aug 1;61(8):680-4.

6. Pryor HB, Thelander H. Abnormally small head size and intellect in children. The Journal of pediatrics. 1968 Oct 1;73(4):593-8.

7. Nelson KB, Deutschberger J. Head size at one year as a predictor of four- year IQ. Developmental Medicine & Child Neurology. 1970 Aug;12(4):487-95.

8. Babson SG, Henderson NB. Fetal undergrowth: relation of head growth to later intellectual performance. Pediatrics. 1974 Jun 1;53(6):890-4.

9. Gross SJ, Kosmetatos N, Grimes CT, Williams ML. Newborn head size and neurological status: predictors of growth and development of low birth weight infants. American Journal of diseases of children. 1978 Aug 1;132(8):753-6.

10. Ounsted M, Moar VA, Scott A. Head circumference and developmental ability at the age of seven years. Acta Pædiatrica. 1988 May;77(3):374-9.

11. Hack M, Breslau N, Weissman B, Aram D, Klein N, Borawski E. Effect of very low birth weight and subnormal head size on cognitive abilities at school age. New England Journal of Medicine. 1991 Jul 25;325(4):231-7.

12. Stathis SL, O'Callaghan M, Harvey J, Rogers Y. Head circumference in ELBW babies is associated with learning difficulties and cognition but not ADHD in the school-aged child. Developmental medicine and child neurology. 1999 Jun;41(6):375-80.

13. Peterson BS, Vohr B, Staib LH, Cannistraci CJ, Dolberg A, Schneider KC, Katz KH, Westerveld M, Sparrow S, Anderson AW, Duncan CC. Regional brain volume abnormalities and long-term cognitive outcome in preterm infants. Jama. 2000 Oct 18;284(15):1939-47.

14. Brandt I, Sticker EJ, Lentze MJ. Catch-up growth of head circumference of very low birth weight, small for gestational age preterm infants and mental development to adulthood. The Journal of pediatrics. 2003 May 1;142(5):463-70.

15. Bartholomeusz HH, Courchesne E, Karns CM. Relationship between head circumference and brain volume in healthy normal toddlers, children, and adults. Neuropediatrics. 2002 Oct;33(05):239-41.

16. Harris SR. Measuring head circumference: update on infant microcephaly. Canadian Family Physician. 2015 Aug 1;61(8):680-4.

17. Lindley AA, Benson JE, Grimes C, Cole III TM, Herman AA. The relationship in neonates between clinically measured head circumference and brain volume estimated from head CT-scans. Early human development. 1999 Sep 1;56(1):17-29.

18. Hack M, Breslau N, Aram D, Weissman B, Klein N, Borawski-Clark E. The effect of very low birth weight and social risk on neurocognitive abilities at school age. Journal of Developmental and Behavioral Pediatrics. 1992 Dec.

Journal of Otorhinolaryngology and Facial Plastic Surgery 2021;7(1):1-7.

https://doi.org/10.22037/orlfps.v7i1.34600

19. Murphy-Berman V, Wright G. Measures of attention. Perceptual and Motor Skills. 1987 Jun;64(3_suppl):1139-43.

20. Avroy A. Fanaroff , Jonathan M. Fanaroff. Care of the high-risk neonate. 5th edition, 2001, W.B. Saunders Co., Philadelphia

21. Nieto A. Neonatal morbidity associated with disproportionate intrauterine growth retardation at term. Journal of Obstetrics and Gynaecology. 1998 Jan 1;18(6):540-3.

22. Tamim H, Beydoun H, Itani M, Khogali M, Chokr I, Yunis KA. Predicting neonatal outcomes: birthweight, body mass index or ponderal index? 2004:509-13.