Congenital hypothyroidism among infants undergoing Thyroid Function Test: A cross-sectional study for prevalence in Gandaki Province

Laxmi Pangeni Lamsal [1], Roshan Pangeni[2], Laxman Bastola[1], Lekhnath Lamsal [3], Anuja Bhandari Thapa [1], Sanjeeta Baral[1]

[1] Department of Pathology, Pokhara Academy of Health Sciences, Pokhara, Nepal
[2] Department of Radiology, Pokhara Academy of Health Sciences, Pokhara, Nepal
[3] Department of Medicine, Shree Army Hospital, Kathmandu, Nepal

Correspondence:

Laxmi Pangeni Lamsal
Department of Pathology
Pokhara Academy of Health Sciences
Western Regional Hospital, Pokhara, Nepal

Email: luxmee011@gmail.com

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ABSTRACT

Introduction: Congenital hypothyroidism, associated with developmental disabilities, is a treatable condition. Initiation of treatment within the first two weeks of life is crucial for optimal outcomes but goes undiagnosed at birth many times due to lack of newborn screening program. This study aimed to find the prevalence of congenital hypothyroidism and age of the diagnosis so that evidence could be generated for the need of newborn screening program.

Materials and Methods: This is descriptive cross-sectional retrospective study. Database of Department of Biochemistry, Western Regional Hospital was accessed to retrieve the report of thyroid function test of 1122 infants who had undergone the test between 1st June 2022 and 31st May 2023. As per the Guidelines of European Society of Paediatric Endocrinology (ESPE), biochemical criteria of TSH and/or FT4 concentration was used to categorise the infant positive for congenital hypothyroidism which is used for initiation of treatment.

Result: Prevalence of the disease was 2.4% out of which 1.7% had TSH >20mU/L. Most common age when infants were diagnosed with congenital hypothyroidism was seven to nine months when 1.07% of the infants were diagnosed. Prevalence of the disease was greater among male infants.

Conclusion: Prevalence of congenital hypothyroidism among infants undergoing thyroid function test is 2.4%. New-born screening should be introduced in medical practice and in health policy because many infants go undiagnosed at time of birth and diagnosed late.

Keywords: Congenital hypothyroidism; new-born screening; thyroid function tests.

INTRODUCTION

Incidence of congenital hypothyroidism (CH) in Nepal is one in 2500 live births which is higher than the global average of one in 3000 to 4000 live births.[1,2] Congenital hypothyroidism (CH) is one of the most treatable conditions that can cause mental retardation and developmental disabilities if left untreated.[3,4] Reports suggest that the treatment outcome has been observed to be the best if treated within the first two weeks of life [5], but it can be difficult to diagnose at birth sometime because the mother's thyroid hormones pass to the child through the placenta. [6]

Newborn screening (NS), started in Canada in 1972, is used to diagnose CH early in life which has been accepted and implemented in some countries as health policy.[7-10] Nevertheless, new-born screening is not yet a part of Nepal's health policy despite its benefits in preventing neuro-developmental disability.[10] We hypothesize that the true burden of the disease in Nepal is not known and high cost of NS are the barriers of NS not being the part of health policy of Nepal. A report of the Lance study of 1976 suggests that T4 screening for CH is an expensive affair and has high false positive report compared to Thyroid stimulating hormone (TSH) screening which has higher sensitivity and specificity at lower cost. [11]

Therefore, to fill the gap, this study aims to assess the prevalence of CH through thyroid function test (TFT) in order to report the burden of disease and support the advocacy of NS for CH in Nepalese health policy.

MATERIALS AND METHODS

A descriptive cross-sectional retrospective study was conducted at the Western Regional Hospital (WRH), Pokhara to determine the prevalence of CH among the infants of Gandaki province. The study population was all infants who were suspected of CH and underwent TFT in WRH. The sample size was calculated from the precision-based formula [$n= z^2p(1-p) / d^2$] with a hypothetical prevalence(p) of 50% at a 95% confidence interval with a 3% marginal error(d) based on previous literature [10]. The calculated sample size was 1067, nevertheless, the final sample size taken was 1122. A purposive sampling technique was used to identify participants. After obtaining ethical clearance from institutional review committee (reference number:188/080), data collection was started. Laboratory reports of all the infants, who had undergone thyroid function test (TFT) within the period from 1st June 2022 to 31st May 2023, were retrieved from the database of Department of Biochemistry Western Regional Hospital (WRH).

All the participants were tested for TFT in venous blood using Chemiluminescence immunoassay (CL-2000i) of Mindray company. Cutoff values for diagnosis of CH or initiating the treatment were defined according to the guidelines of the European Society of Paediatric Endocrinology (ESPE) and the Nelson textbook of paediatrics. As per the guidelines, we followed the biochemical criteria of high thyroid stimulating hormone (TSH) and/or low fT4 concentration for the determination of the prevalence of CH. It means we recognized CH in two ways. First, if TSH>20mU/L and second, if TSH>9mU/L and fT4<0.6ng/dl.

RESULTS

The result showed that the prevalence of CH was 2.14% which was 24 among 1122 infants who underwent the TFT test. When we categorized the age, we found that infants who fell in the category of seven to nine completed months of age were the greatest in number with congenital hypothyroidism. Whereas no case of CH was detected amongst infants up to three completed months of age as delineated in Table 1.

Table 1: Congenital hypothyroidism across age (n=1122)

Age (months)	Congenital hypothyroidism	No congenital hypothyroidism
0-3	0	331 (29.5%)
4-6	6 (0.53%)	216 (19.25%)
7-9	12 (1.07%)	207 (18.45%)
10-12	6 (0.53%)	344 (30.66%)
Total	24 (2.14%)	1098 (97.86%)

Since we used two criteria for determining the CH, we separated them and found that among 24 infants with CH, 20 infants were diagnosed as CH on the basis of high TSH (TSH>20mU/L) alone. The number of males was more than twice that of females who were diagnosed with CH as shown in Table 2.

Table 2: Diagnostic parameter based congenital hypothyroidism(CH) (n=24)

Variables	Categories	CH (TSH>20mU/L)	CH (TSH>9mU/L and FT4<0.6ng/dl)
Age	4-6 months	6 (25%)	0
	7-9 months	8 (33.33%)	4(16.67%)
	10-12 months	6 (25%)	0
Sex	Female	6 (25%)	1 (4.17%)
	Male	14 (58.33%)	3 (12.5%)

DISCUSSION

Thyroid hormone is essential for the development of central nervous system and the deficiency of this hormone at birth is termed as congenital hypothyroidism (CH).[3] Due to the presence of mother's hormone, clinical features sometime remain hidden or absent at the time of birth and babies remain undiagnosed for the CH.[12] Whereas, studies suggest that treatment should be started at the earliest if possible and better within first two weeks of life because inverse relationship has been identified between intelligence quotient and the age of the diagnosis.[5,13] Therefore, new born screening (NBS) using heel prick filter paper dried blood samples first as pilot project and then included in policy in many countries.[14] Nevertheless, new born screening program for CH is not yet the part of national health policy, may be due to the lack of evidence about burden of the disease.

Therefore, this study was started with the aim to find the prevalence of the CH and the age at which it generally gets diagnosed for the treatment so that the seen gap would be partially filled. We conducted this study in Western Regional Hospital(WRH), Pokhara which is a one of the largest tertiary health service providers of western Nepal. We successfully met both the objectives of the study and found the prevalence of the CH and the age at which it was detected in infants.

Prevalence of CH according to this study was 2.14% which was 24 out of 1122 infants and the most common age of the infants when CH was diagnosed was after completion of 6 months upto the Nine completed months of age when 1.07% of infants were detected with CH. On comparison with other two articles, we found that our results were in between the findings of those two. For example, compared to 4.5% prevalence in a study conducted in eastern part of Nepal our finding was almost half while compared to the prevalence of 1.4% as per the study conducted in India, the prevalence of our study was almost doubled.[15,10] The possible cause of the variation in the result may be the techniques of measurements and the sample selection. We included only those infants who were suspected of CH and had been sent TFT after observing clinical features. Additionally, we utilised both FT4 and TSH for the diagnosis of CH. On the other hand, study conducted in BPKIHS, Nepal included infants who were already diagnosed and was under treatment of CH coming for follow-up which brought inflation in their findings from 1.3% prevalence to 4.5% prevalence.[10] Similarly, another study examined all the infants for CH irrespective of the absence or presence of the clinical features. This gave rise to the number the normal children in the study and prevalence might have fallen. But in our study, we included only those infants who had undergone TFT (TSH and fT4) after suspicion of CH due to clinical features and thus prevalence increased. Furthermore, we included both biochemical parameters FT4 and TSH as per the ESPE guidelines while others used only TSH. Had we used only TSH, prevalence of our study would have been only 1.7% which means 20 out of 1122 infants and result would look similar.

Conclusion

Prevalence of 2.4% is well justified as per the study population and research setting and can thus be relied over. Prevalence found in this study was not the outcome of the new-born screening program but was the outcome calculated amongst infants with certain indications or clinical features. Most of the time infant was diagnosed with CH at the age of seven months to nine months rather than at the time of birth. Therefore, new-born screening should be introduced in practice. This study can be used as reference for the health promotion and for health advocacy of screening program for CH.

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