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Frequency of Congenital Hypothyroidism in Neonates Presenting in Tertiary Care Hospital

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Abstract

Background: Congenital Hypothyroidism (CH) is defined as the deficiency of thyroid hormones in newborns that results to possible developmental disabilities if left untreated. That is a reason why early diagnosis and treatment interventions are highly effective in avoiding the further deterioration of the negative outcomes. The occurrence of CH differs from country to country, therefore, investigating its rates and determinants at the local level is warranted.

Aim: The objectives of this study are to establish the prevalence rate of CH in neonates admitted to the tertiary care facility, to define the risk factors of this condition, and to assess the efficiency of the screening procedures applied.

Methods: This quantitative study is a cross-sectional descriptive study carried out over one year in a tertiary care teaching hospital. One thousand neonates were included in the study and screened for CH using TSH and T4 which were obtained by blood sampling through heel prick. Demographic information, maternal health status and details of the births were obtained. Data analysis was done using SPSS to get prevalence rates and test hypotheses on risk factors, while sensitivity and specificity of the adopted screening method were determined.

Results: The source indicates that the prevalence rate of CH in the study was equal to 0. Six per thousand live births or six per cent. Potentially highly relevant factors that were found are maternal thyroid disorders and preterm delivery. The results of the screening method showed high efficiency and reliability, the percentage of positive results was 75%, while the failures were not identified among the negative results. Further analysis showed some relations between CH and congenital heart defects existence and vulnerability of CH development in families with lower socioeconomic status.

Conclusion: Furthermore, the study proves that early detection and intervention in CH patients can help to have better neonatal outcomes. This was the case since the tertiary care hospital had a well-developed screening program hence, the prevalence rate recorded was comparatively low. These results indicate the need to pursue public health interventions that promote and sustain newborn screening and prenatal care of populations at a higher risk.

Keywords: CH, Neonates, Incidence, Detection, Antecedents, Tertiary Care Hospital, NBS, MHA, PPHP

Introduction

Congenital Hypothyroidism (CH) is a condition that affects individuals right from birth due to the absence, underdevelopment or dysfunctioning of the thyroid gland, which in turn does not produce sufficient quantities of thyroid hormones. They are involved in growth and development of the body including the brain and the regulation of metabolism in the body. The gland in the neck region that

synthesizes hormones includes thyroxine or T4 and triiodothyronine or T3 for correct physiological functioning. Thus, thyroid hormones are critical in neonates where brain development and growth is highly sensitive to thyroid hormone concentrations. The above hormones if lacking or deficient, they cause intellectual disabilities, growth retardation among children and other severe health complications if the condition is not well diagnosed and treated [1].

It is imperative to note that CH should be identified and treated as early as possible. Newborn screening programmes using blood spot sampling to identify CH within the first few days of the infant's life has become routinely used in many countries to help avoid negative consequences linked to untreated hypothyroidism. If there is an early diagnosis and then the administration of thyroid hormone replacement treatment, severe cases of intellectual and developmental disabilities can be avoided in patients with the disorder. The treatment is rather non-invasive and not expensive; however, the medicine is remarkable, therefore early diagnostics is a key. When CH is diagnosed, and if treatment is initiated in the first few weeks of life, the neonates have normal developmental profiles; hence, the significance of newborn screening programs [2].

Regarding the global distribution of CH, it also differs tremendously. Moreover, it is estimates that in most populations it is about 2, 000 – 4, 000 live births. Still, these rates are higher in some geographical areas due to genetic and environmental, and iodine deficiency risk factors. For example, places where iodine which is an element used in the production of thyroid hormones is scarce are known to have a high prevalence of CH. Moreover, [3] the application of new and more efficient methods of screening together with implementation of universal newborn screening program brought about changes in the identified cases and subsequently affected the reported incidence. However, the variations demonstrated above have depicted the global prevalence of the disorder stressing the importance of timely diagnosis and intervention to reduce the consequences of CH [4].

This is the case because the following reasons make analysis of how often Congenital Hypothyroidism is discovered in the local population essential? First, it enables one to understand the local incidence and hence determine its impact on disease burden, resources for healthcare and other aspects. Now the possibilities of regional differences because of the genetic and environmental factors, local data are critical to be applied to develop targeted health interventions. For example, if high levels of CH are a reality in specific allowed areas, such as in patients with CH, [5] then one might expect that screening and overall public health consciousness should be higher. Also, early diagnosis and treatment contribute to earnings as many resources used in the long-term treatment of untreated CH can be sparingly spent. The results of this study could thus be used to guide policy formulation in the distribution of health care resources and thus help enhance the wellbeing of the neonates [6].

However, there are some significant research gaps that are presented in the existing literature and which this study intends to fill. As it has already been explained, although there is adequate information from developed countries that have well-established NBSC, little is known about many developing countries. This lack of information means that it is difficult to establish adequate and sufficient health care policies and programs more especially in relation to these environments. Thus, by targeting a local population in a tertiary care hospital, the present study will supplement such studies and fill some of the mentioned gaps. It will also indicate what has been done already on screening and give information on what needs to be done more [7]. It is believed that appreciation of local issues and achievements can inform improvements in screening services with a view of making a positive change that will see all neonates benefit from CH identification and treatment [8].

Therefore, the primary aim of this study is to establish the proportion of congenital hypothyroidism among newborns presenting at a tertiary hospital. This forms the basis of determining the correct prevalence of the overall problem and of the efficacy of current screening regimes. In this way, it will be easier to outline the precise number of affected neonates and, therefore, the further management of CH would be provided with more attention by healthcare providers and policymakers. This objective

also intends to promote the preventive measure as well as early detection measures since early detection is significant in order to avoid the serious complications of CH if not treated [9].

The present study has several secondary objectives besides identifying the educational context in which the frequency occurs: In terms of secondary outcomes, one of them is the evaluation of the risk factors regarding the development of CH within the targeted population. Potential risk factors may involve health condition of the mother, genetic component, and the influence of the environment like iodine deficiency [10] . More insight into the risk factors might assist in the early identification of specific populations vulnerable and coming up with strategies that could assist in decreasing the high incidences of CH. For instance, if deficiency of iodine in the mother has been found to be a major cause of CH, then efforts such as promoting better diet for the mother can be made to reduce the occurrence of CH.

Other aims include the assessment of current screening methods applicable on CH in neonates as another secondary outcome [11]. This include evaluating the success of the tests if they are sensitive, specific, at what time the screening is done and the follow up. Screening is especially important in getting a diagnosis and starting treatment for certain conditions, so the flaws in the existing approaches could result in missed diagnoses and potentially delayed treatment. Since this study seeks to assess the screening process aimed at increasing the early identification and management of CH, assessing areas efficient in this process to determine the gaps that can be filled will be pivotal. The findings of such an evaluation can be used to make suggestions concerning the best strategies which can enhance screening and provide care for all the affected neonates [12].

Methodology

The current research work uses a cross-sectional approach to establish the incidence of CH in neonates admitted to this tertiary health facility. The choice of a cross-sectional design is appropriate for this research since it enables the establishment of the rate of CH at a given point in time hence provide a cross-sectional view of how CH affects the identified population. This design enables the accrued information of the several people at different occasions, thus providing adequate understanding of the prevalence rate and factors it without the time-consuming nature of longitudinal study [13].

The present study is carried out in a renowned tertiary care hospital where neonatal care is provided on a large scale. This hospital functions as a specialty hospital providing specialized care, as well as other necessary medical equipment's for neonates coming from different parts of this region. ICU, NICU, Paediatric endocrinology services, A newborn screening laboratory is also present in the hospital which makes the screening very accurate. The observation period is one year, and as such, it takes a large number of neonates which helps in generating a large database that is useful in the study. This timeframe helps in getting the data in different seasons of the year; this could help in explaining some of the CHs in prevalence due to seasonality [14].

The target group of this study includes neonates who were born in the study timeframe and who were admitted to the tertiary health care setting. The eligibility criteria are newborns addressed at the hospital while the study is conducted, and those who were taken to the neonatal care unit of the hospital within the first 48 hours of birth. The newborns with known thyroid disease history or any kind of diseases that may affect the thyroid gland function, maternal utilization of antithyroid products and iodine are also excluded. Sample size is computed statistically to provide enough power to achieve the study's intended prevalence rate. As per previous investigations and anticipated rates of CH, enrolment of about 1000 neonates is planned, with enough statistical power to compute the point prevalence of CH and adequate number for subgroup analysis [15].

Newborn screening of Congenital hypothyroidism entails the determination of thyroid stimulating hormone (TSH) and thyroxine (T4) levels from drops of blood sampled from neonates. Capillary blood specimens are collected from the heel prick in the initial 48 to 72 hours of the baby's life, based on the newborn metabolic screening guidelines. The collected blood spots are tested at the hospital's

laboratory using extremely selective and accurate enzyme-amplified immunoassays. The procedure of blood sample collection is controlled to reduce variability thereby enhancing the results obtained. Skilled personnel in healthcare conduct the heel pricks to avoid much pain in the neonates. Ethical consideration, and the parents or legal guardians are informed by the healthcare professionals about the screening process, and consent are sought in writing before samples are collected. The consent procedure entails the rationale for the study, the enrolment criteria, the advantages and disadvantages and the anonymity of the findings. This study's analysis is examined and endorsed by the hospital's Research Ethical Committee to meet the legal requirement of ethical practice and subject's welfare.

Descriptive statistics are used to show the proportion of CH among the subjects in the two groups and to assess the relationship between the CH and various risk indicators. The demographic information and the Prevalence Rate of CH are analysed using frequencies, and percentage. Chi-square tests and logistic regression are used in the research to examine relationships between CH and risk factors, including mothers' health issues, birth weight, and family history of thyroid disease. Database analysis is done statistically with the help of statistically inclined software like SPSS or R etc., which delivers precise results. Descriptive and cleaning data tools, statistical and analytical tools work together to help give a general picture of study results. The specialization of missing data is another important consideration that has been incorporated in the analysis. Data can be a result of incomplete records or unsuccessful sample collection at the point of sampling. In any case, to be able to include all the observations in the analysis, multiple imputation techniques are used to handle the issue of missing data. The multi variate pattern is checked and analysed to determine the effects of the missing data pattern thus keeping the results efficient and accurate notwithstanding the gaps [16].

Prevalence is determined in this case to show usefulness through specifying the precise number of CH affected neonates by dividing the confirmed CH cases by the number of screened neonates in a population, unlike specificity which shows the proportion of true positive cases out of those that are perceived to have the disease. The variables under consideration are tested individually against the match-paired controls and then using the multivariate logistic regression analysis to establish the potential predictors of CH whilst controlling for the confounding factors. This approach enables one to establish primary predictors of CHs separate from the over-arching problem, which will enable possibly preventions and intervention that may be of aid since they are adjusted specifically for the condition in contemplation.

The approach of this study also guarantees systematic and efficient approach of establishing the prevalence of Congenital Hypothyroidism among neonates. The study design and target sample are cross-sectional, setting is comprehensive, and data collection and data analysis methodology are appropriate and reliable. A key aspect relating to inclusion of ethical consideration is that participants' rights are respected, and independence of the research upheld. The findings of the study would be useful in the generation of more data regarding the level of CH prevalence and its risk factors within the local population to enhance the formulation of relevant health care policies in an effort to promote improvement in neonatal health [17].

Results

A total of 1,000 neonates admitted in the tertiary care hospital during the study period were included in the study. As to the gender distribution, 510 students out of 1000 subjects were males, which constituted 51%, while 490 students were females, accounting for 49%. The mean birth weight of the neonates was 3. mean = 2 kg, with st.dev = 0 5 kg. Of the neonates, 85% was born at full term, 37 to 42 weeks while the rest 15% was born preterm below 37 weeks. The demographic information also revealed that 70% of the neonates' mothers were in the age range of 20 to 35 years while the remaining 30% of the neonates' mothers were either below 20 years or above 35 years of age. The following was the prevalence of maternal health issues: thyroid disorder 12%, gestational diabetes 8%, and hypertensive disorders of pregnancy 5%. The analyses of the families' socioeconomic status

indicated that sixty percent of them were middle income, twenty-five percent low income, and fifteen percent high income.

From the study conducted among the chosen population, it was revealed that the incidence rate of CH was 1/1500 live births. In particular, six out of the one thousand surveyed neonates tested positive for CH, hence the prevalence rate computed at 0. 6%. This rate is in the lower streaming of the identified global range / CH prevalence ratio, ranging from 1/2000 to 1/4000 live births and therefore reveal low CH rate amongst the study population. When comparing the results of this study with other regional studies, this study's prevalence rate is somewhat lower than the average prevalence of some similar studies which ranges between 0. 8% to 1%. This could mean that the good prenatal care and neonatal screening programs of the tertiary care hospital could have attributed to lower incidence of CH [18].

Based on the preliminary cross-sectional examination of the risk factors of CH, the following findings were established. Among explored factors, the presence of thyroid disorders among mothers was rated as important, as the risk of CH in neonates born to mothers with thyroid disorders was significantly higher. The six affected children had been diagnosed with the condition and of these, four had mothers who have previous thyroid problems, which shows the genetic factor is dominant. Further, CH occurrence was also increased among neonates born to mothers with gestational diabetes; however, significance was not reached in this study likely due to small sample size in affected cases. Regarding the demographic characteristics, low birth weight and preterm birth also seemed to be risk factors for CH. Three of the CH cases were preterm and three of them weighed below 2,000 grams at birth out of 6 CH cases. 5 kg. The results of this study are in harmony with the earlier observations that described increased risk of thyroid dysfunction in preterm or low birth weight neonates. Risk factors, including maternal iodine deficiency, an environment factor, were not evaluated in this research but are reported to be a threat to CH in the global arena.

Generally, the methods of screening applied in the study were efficient in identifying the clients with CH. The first filter involved estimating TSH from a drop of blood obtained from heel prick of the infant. The neonates with abnormally high TSH had repeat blood test for T4 and further clinical assessment. The screening programme gave 8 neonates with raised TSH and on follow up investigation, 6 of them were diagnosed with CH. This gave a positive predictive value of seventy five percent, meaning the screening method employed was accurate, however False Positive rates were noted. Precisely, two patients had FP results in screening TSH where no CH was found on more detailed examination. In particular, no false negative cases were to be noted, which proves the effectiveness of the screening criteria. This effectiveness also depicts why screening at an early state is very vital for identification of CH and the starting point of the respective treatment.

While the major concern of the research was focused on CH, other nursing peripheral but closely related discoveries were identified concerning neonatal health. Of these, one special mention was made concerning the relationship between CH and other diseases that occur in the neonatal period. He also provided examples, and 2 of the neonates diagnosed with CH also presented some signs of congenital heart defects and thus, assumed a relationship between thyroid malfunctions and cardiac disorders. Future studies regarding this relationship might help reveal more about the coexistence of these diseases. Similarly, the high percentage of CH and the distribution of the condition according to the economic status of a community was also established. It was also seen from the data that the rate of CH was quite high among neonates from low-income families. While it was impossible to derive a conclusion from such a small sample, this finding is commensurate with other studies that related the population's low socioeconomic status to the development of numerous diseases, including thyroid diseases, owing to unstable diets and limited health care.

Furthermore, educational level and awareness of the mother also stressed as the way forward to lowering the chances of CH. According to the conclusion made above, it is evident that those mothers who were well educated during prenatal care concerning healthy diets and thyroid health were healthier couples during pregnancy and their neonates. This underlines the need for the prenatal care

programs that carefully involve the education on thyroid health. The data also showed that born to mothers who had consistent prenatal care, had less prevalence of CH, thus stressing the importance of regular medical check-ups and subsequent interventions.

Factor	Description	Prevalence/Impact
Gender Distribution	51% males (510/1000), 49% females (490/1000)	Gender distribution among neonates admitted in the study.
Birth Weight	Mean = 2 kg, Std Dev = 0.5 kg	Mean and standard deviation of birth weights observed in the neonatal population.
Gestational Age	85% full term (37-42 weeks), 15% preterm (<37 weeks)	Percentage distribution of neonates by gestational age categories.
Maternal Age	70% mothers aged 20-35 years, 30% mothers <20 or >35 years	Distribution of maternal age groups among the study participants.
Maternal Health Issues	Thyroid disorder 12%, Gestational diabetes 8%, Hypertensive disorders 5%	Distribution of maternal age groups among the study participants.
Socioeconomic Status	60% middle income, 25% low income, 15% high income	Distribution of families based on socioeconomic status.
CH Prevalence	0.6% (6/1000 neonates)	Prevalence rate of Congenital Hypothyroidism (CH) among the study population.
Screening Method	TSH estimation from heel prick blood, followed by T4 test	Method used for screening neonates for CH during the study period.
Additional Health Findings	CH linked to congenital	Observations regarding

	heart defects, high CH prevalence in low-income families	associations between CH and other health conditions, socioeconomic impacts.
Importance of Prenatal Care	Lower CH prevalence in neonates of mothers with consistent prenatal care	Impact of consistent prenatal care on CH incidence among neonates.

Discussion

Based on the finding of this study, the incidence rate of Congenital Hypothyroidism (CH) that was identified among the study participants was zero. One in every 1,500 live births are affected by this condition accounting to 6% of the population. This prevalence finding falls within the countries' range of 1 in 2,000 to 1 in 4,000 live births and suggests that there is still a lot that needs to be done to reduce congenital anomalies rates. The reason for the slightly lower prevalence in this current study could be blamed on the efficient prenatal care and screening service offered at the identified tertiary care hospital. Maybe the reason for these perinatal health outcomes were less affected by CH because the cited hospital offered comprehensive prenatal care to pregnant women. Besides, a comprehensive research procedure to screen candidates helped in early identification and diagnosis of CH, which is vital in treatment and the prevention of complications.

As compared to other related studies, the prevalence rate identified in this study is within the range of similar settings; however, slightly lower as compared to the average prevalence discussed in the regional data which varies between 0. 8% to 1%. This indicates that the hospital's efficient screening and health care may be contributing a lot in the control and prevention of CH. The observed prevalence rate is consistent with the estimated outcomes in term of hospital's extensive neonatal care delivery which focuses on screening the neonate at birth and an early opportunity to initiate any care. Nevertheless, it should be kept in mind that prevalence rates differ by the degree of hereditariness, the environmental conditions of the area, history of screening and efficiency of programmes.

The outcomes of the study are important on the healthcare of neonates and future public healthcare initiatives. The use of early detection and intervention strategies followed in the tertiary care hospital and this study published, entail the documentation of a relatively low prevalence of CH compared to other health facilities. That is why early screening of children for CH is important because if not treated on time, can cause severe delay in intellectual or developmental activities. It concludes that value should be placed on the sustainment and improvement of newborn screening in order to increase the screening of all neonates for CH within the first 48 hours of life. These programs are essential in diagnosing the condition early, since early treatment has no adverse effects, it helps in preventing severe consequences of CH such as growth retardation and low intelligence.

Moreover, the results of the present research point to the further public health calls to increase awareness among physicians and caregivers about the CH identification and management at an early age. It is crucial for public health policies to direct more resources and focus on the programs of newborn screening with a concentration on the areas with a higher prevalence of CH. Also, the services under the PHC should target the maternal care since issues such as thyroid disease and gestational diabetes were demonstrated to be potential risks to CH. It is recommended that the identified risk factors of CH be targeted in policies that develop and enhance the health of neonates to reduce the prevalence of CH.

These districts are a few of the research strengths that enhance the internal and external validity of the study outcomes. However, one of the study's main assets is a large sample, including 1000 neonates,

which may help researchers investigate the extent of CH and potential risk factors. That thorough screening procedures were applied in the study where TSH and T4 levels were assessed, meant that the studied CH cases would be correctly identified. Due to the universal guidelines in the taking of blood cultures and the stringent measures that were applied on subsequent analysis, possibility of type I and type II errors were reduced making the study more valid.

However, it should also be noted that the current study has several limitations to which attention should be paid. There is a potential limitation in the generalizability of the study findings because this research was conducted in a single tertiary health care canter in India and the opinions may differ in other types of health care sector especially the rural health sector or health care centers with lower facility provisions. The results may not accurately depict the other regions because the hospital has quality new borne care, and efficient screening procedures which may not depict the general situation as other regions where people cannot even access good health care and screening. Also, referral bias might be an issue with this, as neonates with more health complications may likely to be referred for tertiary care hence changing the rate recorded in our study. One of the limitations is the study duration of one year; this may not Alam et al: Prevalence and Factors Associated with Chronic Hypertension among 5 capture all the trends towards CH prevalence or seasonal variations.

Based on its results, this study offers a starting point for subsequent research in several fields. Future works should try to expand this study to multiple centers and other settings in order to increase the applicability of the findings. The findings of multi-center studies will help in gaining a more objective picture of the factors that determine the prevalence of CH in various regions and settings. Nevertheless, further research on CH should be conducted to explain the genetic factors of this problem. Molecular analysis involves identification of these specific alleles or other aspects of the patients' genomes that could offer pointers on how to avoid the onset of CH or at least treat affected individuals with the specific genetic makeup.

Longitudinal investigations are also suggested to see the impact on neonates with CH and the efficacy of the early intervention programmes. These studies can follow up the CH affected individuals for their developmental and health status and therefore give data on the effects of early diagnosis and management of CH. Furthermore, studies should be conducted to establish the effects of some of the environmental mentions like for instance maternal iodine deficiency towards CH. Knowledge of the contribution of these factors would help the development of the outlined government actions in an effort to alleviate the incidence of CH through nutritional changes and awareness.

Conclusion

The present research on the occurrence rate of Congenital Hypothyroidism (CH) among neonates in a tertiary care center established that, of the total births recorded in the facility during the nine months in question, 0. 6 % of the screened patients supported the international and regional data and stressed on the efficiency of the hospital's screening programmes. The fact that maternal thyroid conditions that were detected during pregnancy, and preterm birth were mentioned as the risk factors clearly indicates that there should be more attention paid to the education concerning various prenatal conditions. The results of the study support the hypothesis that timely diagnosis and treatment is the only way to avoid the development of severe comorbidity related to CH. Such findings can contribute to clinical practice by emphasising the need for an extensive program in the identification of diseases in newborns as well as timely initiation of treatment. Therefore, it is suggested that all healthcare providers incorporate child screening into their practises and evaluate the history of maternal health when assessing neonates. In conclusion, based on the findings of this study, early identification of CH is necessary to enhance neonatal outcomes and increase the chances of good survival among the population, therefore calling for effective public health policies for optimal wellbeing of all neonates.

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