RESEARCH
www.commprac.com
ISSN 1462 2815

SCREENING CONGENITAL HYPOTHYROIDISM WITH CORD BLOOD THYROID STIMULATING HORMONE (TSH)

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DOI: 10.5281/zenodo.13772334

Abstract

Congenital hypothyroid screening through cord blood TSH levels is a significant preventive measure to detect and manage this condition early. This systematic review discusses congenital hypothyroid screening through cord blood TSH levels for hypothyroid screening by going through several stages: formulating questions, sorting and eligibility of articles, selecting articles to be used, and scoring articles. The article selection process uses the prism flow, and based on this flow, nine articles are obtained that match the research objectives. Various findings from various studies indicate that cord blood TSH estimation is a sensitive and specific marker for screening congenital hypothyroidism, so hypothyroid detection The use of cord blood TSH as a screening tool for congenital hypothyroidism in preventing mental retardation in infants.

Keywords: Umbilical Cord Blood, Hypothyroidism, TSH.

INTRODUCTION

Congenital hypothyroidism (CH) is a condition in which the thyroid gland's ability to produce thyroxine hormone is impaired, resulting in insufficient levels of thyroxine in the body. It is the most prevalent preventable cause of intellectual disability worldwide and the most prevalent congenital endocrine disorder (Nallagonda et al., 2023**)**.

The incidence rate of congenital hypothyroidism seems to have increased over the last few decades due to a decrease in the cut-off time for TSH screening through newborn screening programs, thus increasing the discovery of milder cases in newborns (Alameer et al., 2022). Various screening programs have provided evidence indicating that the prevalence of CH is greater in preterm and low-birth-weight (LBW) infants compared to those with normal birth weight (Khodabandeh et al., 2022).

In newborns, the clinical signs of hypothyroidism, whether mild or asymptomatic, typically become apparent within a few months of birth. The symptoms include a decrease in physical activity, an increase in the duration of time spent sleeping, constipation, jaundice, a distinctive facial shape, an enlarged tongue, abdominal distension, and other symptoms. Particularly noteworthy is the fact that growth retardation becomes increasingly apparent between the ages of four and six months if it is not treated, which can potentially result in intellectual impairment and stunted growth (Fúnez et al., 2019).

Population screening programs based on public health need to be thorough and well-coordinated, this includes educating parents and healthcare providers, using standard screening methods, figuring out the results, making follow-up calls, getting

a second set of tests to prove the diagnosis, starting treatment, and evaluating the program. Screening for congenital hypothyroidism (CH) meets all of these criteria but has yet to be realized as a public health program. (Arulmohi et al., 2017).

Several measures are being taken to improve the quality of life for future generations, one of which is the screening of newborns for congenital defects. During the first few days of a baby's life, a test known as neonatal screening is carried out to differentiate between healthy babies and babies with congenital defects. The screening of newborns can uncover congenital diseases at the earliest possible stage, allowing for intervention to be carried out as quickly as possible if they are discovered. The early discovery of congenital hypothyroidism provides the opportunity to begin therapy prior to the age of two weeks. There are a variety of screening procedures available for this purpose. When considering the temporary rise in TSH that occurs during the first twenty-four to forty-eight hours of a baby's existence, it is essential to screen all newborns (Chaudhary et al., 2018).

Recent advancements in laboratory research have empowered clinicians to enhance the quality of life for newborns diagnosed with congenital hypothyroidism. The development of sensitive and specific assays to measure TSH using cord blood and heel prick blood enabled the initiation of a highly cost-effective newborn thyroid screening program. Thus, early diagnosis and treatment will save detected children from intellectual disability. (Hashemipour et al., 2018), (Anne & Rahiman, 2022).

Cord blood (CB) remains a convenient alternative for screening purposes in this process is painless and also Since most mothers are discharged early, cord blood TSH (CB-TSH) screening for congenital hypothyroidism (CH) is an effective strategy, so this systematic review aims to determine the comparison of the sensitivity and specificity of cord blood TSH and heel prick that has been studied in detecting congenital hypothyroidism (CH) in newborns.

RESEARCH METHODS

This journal was compiled using the systematic review stage with the cross-sectional method, using the keywords congenital hypothyroid screening with cord blood. Then, search for Science Direct, Pubmed, and Google Scholar data sources using the keywords Cord Blood, Hypothyroid, and TSH. After searching the data with these keywords, 924 articles were obtained. After searching the data with these keywords and combining them with the words "or" and "and," articles that used Indonesian or English were obtained. Then, the data sources were searched in Science Direct, Pubmed, and Google Scholar. There 313 articles were from Google Scholar, 611 from Science Direct, and 16 from Pubmed. Document selection uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow and determines the inclusion and exclusion criteria of articles published in 2019-2024. From these articles, screening is carried out by selecting relevant articles; there are 19 articles, then reading the entire contents of the article, and then nine articles are obtained that match the inclusion criteria. The following article's research flow chart can be seen in Figure 1.

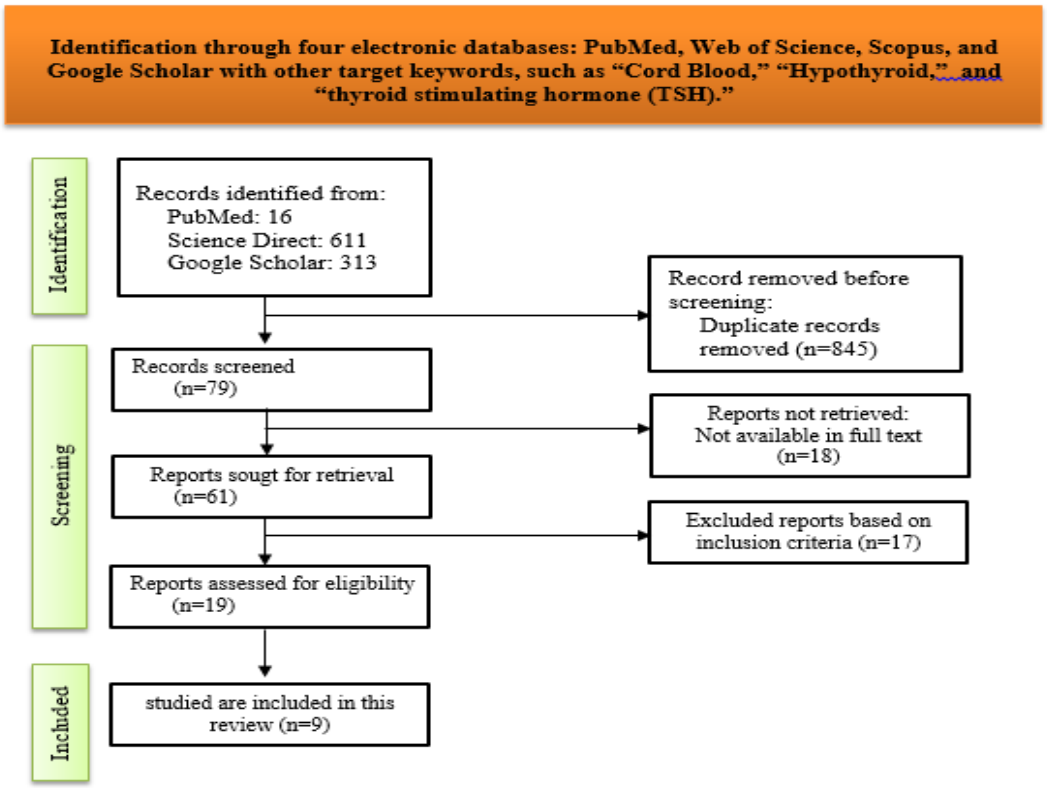

Figure 1: PRISMA Flow Diagram Results

RESULT

Based on the data in Figure 1, cord blood sampling was a feasible method for assessing Thyroid Stimulating Hormone (TSH) levels in neonates as a screening measure for congenital hypothyroidism. Therefore, from the searches and articles that fit the predetermined criteria, to determine the comparison of the sensitivity and specificity of cord blood TSH that has been studied in detecting congenital hypothyroidism (CH) in newborns, the results are shown in Figure 1 below:

Table 1: Journal Review Results of Congenital Hypothyroid Screening with Cord Blood

Author and Year	Objective	Method	Sample	Results
Fahad Al Juraibah, Ali Alothaim, Wafa Al Eyaid, Angham Nasser Al Mutair in 2019	Comparing the sensitivity and specificity of cord blood and heel prick samples for determining thyroid stimulating hormone (TSH) levels in CH detection.	cross-sectional study	17729 newborns at King Abdulaziz Medical City in Riyadh	Of the 17,729 neonates screened, 7 were diagnosed with primary CH. All confirmed cases were detected by both cord blood TSH levels and heel prick: 88 positive cord blood results (sensitivity 100%, specificity 99.6%, with recall rate 0.04%) and 305 positive heel prick results (sensitivity 100%, specificity 98.3%, with a recall rate of 1.68%).
Faten Ghanem, Rayan Itani,	Determine the relationship between cord	cross-sectional study	Cord blood for cord TSH	The mean cord blood TSH was 6.8 compared to the mean heel prick TSH of 5 (P

Amal Naous, Bassem Abou Merhi, Mariam Rajab, in 2020	blood TSH taken at birth and TSH from heel prick filter paper routinely taken for neonatal screening at 24-48 hours of life.		and heel prick samples were taken 24-48 hours after birth.	value <0.0001) but remained within normal limits.
Rohan Modi, Harsh Mod, Aabha Phalak, in 2020	finding the effectiveness of cord blood TSH as a screening tool for congenital hypothyroidism	cross-sectional study	1687 newborns Cord blood for cord TSH, and samples from heel puncture taken at 72 hours after birth	Of the 1687 neonates born during the study period, CBTSH values varied from 1.3 mIU/L to 101.4 mIU/L with a mean CBTSH of 7.21 mIU/L. 28 (1.8%) infants had CBTSH levels >20 mIU/L. Of these, four were later diagnosed with congenital hypothyroidism. All four had CBTSH levels >20 mIU/L. All other neonates with CBTSH levels less than 20 mIU/L were found to have normal screening results after birth.
Seham Alameer, Eman Althobaiti |,Saud Alshaikh Meshari Turjoman in 2021	comparing the sensitivity and specificity of cord blood TSH and heel prick in detecting congenital hypothyroidism (CH) among screened newborns	cross-sectional study	21,012 newborns King Abdulaziz Medical City (KAMC), Jeddah, Saudi Arabia	Of the total newborns screened, 12 were confirmed to have primary congenital hypothyroidism. Nine cases were positive for cord blood TSH (sensitivity 75%, specificity 99.9%, and recall rate 0.004%), while 139 cases were positive for heel prick blood TSH (sensitivity 100%, specificity 99.3%, and recall rate 0.60%).
Subhash Poyekar, Shilpa Pratinidhi, Swapnil S Prasad, Zainab S Sardar, Bhavesh Kankariya, Om Bhole in 2019	Determine the various maternal and perinatal factors that influence CB-TSH levels.	cross-sectional study	726 babies born at Bhausaheb Sardesai Talegaon Rural Hospital (BSTRH), Pune, from November 2016 to April 2018	A total of 726 newborns were included in this study. The mean CB-TSH was 8.9 µIU/mL, with 54 (7.5%) newborns having values greater than 20 µIU/mL. CB-TSH was significantly elevated in male infants in first-order neonates born through vaginal delivery.
Rohini Gulhane, Amit Gulhane, Sachin Muley, Swati Maldhuri in 2021	To examine the effectiveness of cord blood TSH as a screening tool to detect congenital hypothyroidism and determine the cut-off levels of	cross-sectional study	122 babies born in the pediatrics department at Shalinitai Meghe	Venous blood TSH values >10 mIU/mL on day 4 postnatal suggest congenital hypothyroidism. Cord blood TSH values < 20 mIU/mL can be safely used as a threshold limit for the purpose of screening for congenital hypothyroidism in countries

	cord blood TSH and peripheral venous blood TSH on day 4 postnatal for screening congenital hypothyroidism.		Hospital	like India.
Abbas M, Tayrab E, Elmakki A, Eltayyeb tayrab in 2020	Analysing the epidemiology of CH using cord blood TSH screening		2501 newborns were born from January to November 2016 in Bisha, Saudi Arabia.	A total of 1308 (52.3%) neonates were male, while 1193 (47.7%) were female. Serum TSH levels ranged from 0.01-73.9 µU/ml. The mean ± SD was 7.60 ± 6.02 µU/ml; the threshold point was 25 µU/ml.
Zion, Gaddam Eluzai; Raheemunnisa in 2020	Comparing the sensitivity and specificity of cord blood and heel prick samples for determining thyroid stimulating hormone (TSH) levels in CH detection.	cross-sectional study	73 newborns born to Sri Venkata Sai Medical College and Hospital from 28 August to 28 February 2019	Cord blood TSH levels >20 mIU/L were present in 10% (7) neonates. When blood TSH levels were repeated (on day 3) among those with high cord blood TSH levels (>20), blood TSH levels were also high (>20) in 6 (85.7%) neonates and low (<20) in 1 (14.2%). In neonates with cord blood TSH >20, 6 neonates also had low T4 levels (T4<7) (85.7%), and 1 neonate (14.2%) had T4>7. In this study, 6 neonates (85.7%) had Congenital Hypothyroid. This study found that cord blood TSH as a diagnostic tool has 100% sensitivity and 98.5% specificity in diagnosing congenital hypothyroidism.
M. F. Bashir, A. Elechi, Jarrett, E. Oyenusi, Oduwole, in 2022	Determine the normative value of Thyroid Stimulating Hormone (TSH) in cord blood among term infants in Bauchi, North-East Nigeria	cross-sectional study	200 babies	The cord blood TSH levels of most term infants in Bauchi, similar to other studies in Nigeria, were <10 µIU/ml.

DISCUSSION

Congenital hypothyroidism (CH) is the most common endocrine disorder in pediatric patients, posing a significant risk to infants due to the potential for permanent cognitive impairment if not promptly identified and managed. (Al-Mendalawi, 2019) Thyroid hormones are crucial for the normal development and growth of the brain, specifically in processes like myelinization and the establishment of neuronal connections. The initial postpartum months are crucial, and thyroid hormones

facilitate brain maturation and growth. Hence, it is crucial to promptly detect and address issues connected to thyroid hormones. Screening for low birth weight and preterm infants should be conducted and repeated one month following birth. Individuals with congenital hypothyroidism experience cognitive impairment, which is marked by a decline in quality of life, lower self-esteem, and difficulties in social integration. These characteristics can be ascribed to deficiencies in Intelligence Quotient (IQ). (Prezioso et al., 2018), (Nolan et al., 2024), (Octavius et al., 2024).

Cord blood sampling is strongly associated with heel sampling in assessing thyroid-stimulating hormone levels, demonstrating its validity as a potential approach for neonatal congenital hypothyroidism screening. (Juraibah et al., 2019), (Chen et al., 2023) The presence of thyroid-stimulating hormone (TSH) in cord blood is a reliable indicator of thyroid function in neonates, given that these specimens are collected soon after delivery, before substantial physiological changes. These babies should be sampled between two to four days of life. However, if this is not possible, screening should be done before seven days of age, as mothers who have given birth are usually discharged before their babies are two to 3 days old. Screening before discharge is always better than missing the diagnosis. (Knapkova et al., 2018; Rose et al., 2023) The use of cord blood to screen for congenital hypothyroidism is becoming a viable and effective method for early diagnosis, leading to improved opportunities for earlier intervention to prevent mental and developmental disabilities.

CONCLUSIONS AND SUGGESTIONS

Cord blood TSH screening offers benefits because of its simplicity of collection, non-invasive nature, and improved parental adherence, resulting in faster results. It remains unaffected by perinatal stress circumstances or the method of birth, making it the optimal choice for screening for congenital hypothyroidism. Nevertheless, this study offers significant insights into the most effective screening approach for congenital hypothyroidism. This underscores the necessity for additional investigation to enhance the precision and effectiveness of early identification of congenital hypothyroidism.

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