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Original Research Article

ETIO-CLINICAL PROFILE OF CHILDREN WITH HYPOTHYROIDISM IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Hypothyroidism is among the most common endocrine disorders in children, significantly impacting growth, metabolism, and neurodevelopment. Despite being preventable, delayed diagnosis remains a challenge in India due to the lack of universal neonatal screening and low clinical suspicion. This study aimed to assess the etio-clinical profile, demographic distribution, and associated comorbidities of hypothyroidism in pediatric patients attending a tertiary care center in Indore, Madhya Pradesh.

Materials and Methods: A cross-sectional analytical study was conducted over 18 months (April 2021 to September 2022) at the Department of Pediatrics, Sri Aurobindo Medical College and Postgraduate Institute, Indore. A total of 80 children aged from birth to 18 years, diagnosed with hypothyroidism, were enrolled. Data regarding clinical features, growth parameters, and thyroid function tests were collected using a structured proforma. Nutritional status was assessed using Z scores for height, weight, BMI, and weight-for-height ratios. Statistical analysis was performed using SPSS version 20.0, with p-values <0.05 considered significant.

Results: The majority of patients were diagnosed between 5–10 years of age (30%), with a female predominance (61.3%). Acquired hypothyroidism (56.3%) was more common than congenital hypothyroidism (43.8%). Growth retardation (46.3%), lethargy (36.3%), and constipation (27.5%) were the most prevalent clinical features. Pallor (45%), dry skin (31.3%), and oedema (28.8%) were common systemic findings. Short stature was observed in 33.8% of patients, and underweight status in 27.6%. Thyroid profile revealed elevated mean TSH levels (63.41 mIU/L), confirming hypothyroidism.

Conclusion: The study highlights delayed diagnosis, particularly in congenital cases, due to non-specific early features. Regular growth monitoring, thyroid screening, and clinician awareness are crucial for early detection and timely management to prevent long-term complications in pediatric hypothyroidism.

Keywords: Hypothyroidism, short stature, pediatric.

INTRODUCTION

Thyroid gland disorders are recognized as one of the most prevalent endocrine problems in India, with hypothyroidism being particularly common in the pediatric age group.[1,2] Hypothyroidism, more frequently encountered than hyperthyroidism, remains a leading preventable cause of mental retardation.[3,4] With India's large population of over 1.25 billion, approximately 42 million individuals are estimated to suffer from thyroid-related disorders.[1] These disorders present as a spectrum involving either hypo- or hyperfunctioning of the thyroid gland, typically reflected through variations in serum Tri-iodothyronine (T3), Thyroxine (T4), and Thyroid Stimulating Hormone (TSH) levels. Depending on the site of dysfunction, thyroid disorders are categorized as primary (thyroid gland), secondary (pituitary), or tertiary (hypothalamic).[5]

Thyroid hormones play a crucial role in fetal development, postnatal growth, metabolism, and neuropsychological functioning.[6,7] Deficiency of

these hormones, particularly during the early stages of life, may lead to significant metabolic derangements and irreversible neurodevelopmental damage.[7] Early identification and appropriate management of hypothyroidism are critical in preventing associated morbidity, especially in children where thyroid hormone deprivation can profoundly affect cognitive and physical development.[6] Pediatric hypothyroidism may be congenital or acquired, with the acquired form often termed juvenile hypothyroidism (JH), which can be either subclinical (SCH) or overt hypothyroidism (OH).[8] Congenital hypothyroidism, with an incidence of 1:2500 to 1:2800 live births in India, is largely attributed to thyroid dysgenesis and dyshormonogenesis.[3,9]

Congenital hypothyroidism frequently presents with nonspecific or absent clinical features at birth, often delaying diagnosis until irreversible CNS damage has occurred. Early detection through neonatal screening and timely intervention are therefore essential to prevent long-term cognitive impairment.[10-12] Acquired hypothyroidism, commonly seen in school-aged children, may initially manifest as growth deceleration. Chronic lymphocytic thyroiditis is identified as the most common cause, although autoimmune and iatrogenic factors may also contribute.[13] In contrast, hyperthyroidism is rare in the pediatric population but can lead to accelerated skeletal growth and systemic hypermetabolic effects.[3,11]

Despite the presence of national programs like the National Iodine Deficiency Disorders Control Program (NIDDCP), thyroid disorders remain widespread in India.[14,15] The absence of universal neonatal screening in the country continues to be a significant barrier to early diagnosis. Furthermore, limited data exist on the prevalence, clinical presentation, and etiological patterns of pediatric hypothyroidism, particularly in resource-limited settings.[16] Recognizing the critical role of thyroid hormones in neurodevelopment and growth, the current study was designed as a cross-sectional observational study to evaluate the prevalence, clinical profile, etiology, and associated comorbidities of hypothyroidism among children attending a tertiary care center in Indore, Madhya Pradesh.

MATERIALS AND METHODS

After obtaining approval from the Institutional Ethical Committee, this cross-sectional analytical study was conducted over a period of **18 months**, from **1st April 2021 to 30th September 2022**. A total of **80 pediatric patients**, aged from birth to 18 years and diagnosed with hypothyroidism, were enrolled in the study. The participants were selected from both the **outpatient department (OPD)** and **inpatient department (IPD)** of the Pediatrics Unit, following the established inclusion and exclusion criteria designed for the study.

Inclusion Criteria

- Children aged from birth to 18 years with confirmed hypothyroidism (defined by low T4/Free T4 levels with elevated TSH levels).

Exclusion Criteria

- Obese children showing slightly raised TSH levels (5 to 10 IU/ml) without significant thyroid hormone deficiency.
- Children with subclinical hypothyroidism (mildly elevated TSH with normal Free T4 levels).
- Children whose parents or guardians did not provide written informed consent for participation.

Study Procedure:

Eligible patients fulfilling the inclusion and exclusion criteria were enrolled after obtaining **written informed consent** from their parents or guardians. A detailed history, including demographic data, family history, clinical features, associated comorbidities, and treatment details, was recorded using a **pre-designed structured proforma**.

A thorough **clinical examination** was performed for each participant. Relevant laboratory and imaging investigations were conducted as indicated, and the findings were documented systematically.

Investigations Performed:

1. **Thyroid Function Tests:** Free T4/T4, TSH, and thyroid auto-antibodies.
2. **Ultrasound (USG) Thyroid:** To assess thyroid gland morphology.
3. **Thyroid Scan and Fine Needle Aspiration Cytology (FNAC):** Performed selectively where required for further evaluation.
4. **Other Relevant Investigations:** Depending on the presence of associated conditions or comorbidities.

Statistical Analysis

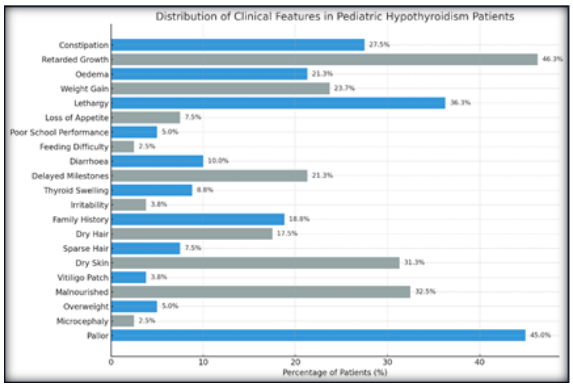
The collected data were compiled using Microsoft Excel and analyzed using SPSS software version 20.0. Descriptive statistics were applied to summarize the data. Continuous variables were expressed as mean ± standard deviation (SD) along with minimum and maximum values, while categorical variables were presented as frequencies and percentages. The Student's t-test was used for comparing quantitative variables when the data followed a normal distribution. The relationship between categorical variables was assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant throughout the analysis. The prevalence of hypothyroidism along with 95% confidence intervals was also calculated.

RESULTS

The present study on 80 pediatric patients with hypothyroidism provides key insights into the

clinico-demographic profile of the disease. The majority of diagnoses were made between 5–10 years of age (30%), with a notable female predominance (61.3%). Acquired hypothyroidism (56.3%) was more common than congenital hypothyroidism (43.8%), indicating frequent detection beyond the neonatal period. [Table 1].

Common clinical features included growth retardation (46.3%), lethargy (36.3%), and constipation (27.5%), while delayed milestones (21.3%) were observed mainly in congenital cases. Less frequent symptoms were poor school performance (5%), feeding difficulties (2.5%), and diarrhea (10%). Goiter was present in 8.8% and irritability in 3.8%. [Graph 1]



Graph 1. Distribution of Clinical Features in Pediatric Hypothyroidism Patients

Birth weight between 2.5–3.0 kg was most common (45%), with 6.3% being small for gestational age. A positive family history was noted in 18.8%, particularly in acquired cases. Physical signs like dry or sparse hair (25%), dry skin (31.3%), and vitiligo patches (3.8%) suggested autoimmune involvement. Nutritional assessment revealed malnutrition in 32.5%, while microcephaly and pallor were seen in 2.5% and 45% of patients, respectively. [Table 2]

In the present study, growth assessment using Z score analysis revealed that short stature (Z score HT < -2 SD) was present in 33.8% of children with hypothyroidism, indicating significant growth impairment in a substantial proportion of the cohort. Weight assessment showed that 27.6% of children were underweight (Z score WT < -2 SD), while the majority-maintained weight within the normal range. BMI analysis reflected that 37.7% of children fell within the -2 SD to -1 SD category, suggesting mild undernutrition in a considerable segment. The WT/HT Z score indicated that 60% of the participants were within -1 SD to 0, demonstrating relatively balanced weight-to-height proportion in most children. Regarding head circumference, although a large number of measurements were not available, among the assessed children, 6.3% had values between -2 to -3 SD, suggesting microcephaly in a small subset. These findings emphasize the presence of significant growth disturbances in pediatric hypothyroidism, underlining the need for regular anthropometric monitoring as part of disease management. [Table 3]

The analysis of mean values and standard deviations across various clinical and thyroid parameters demonstrated notable variations within the study population. The mean birth weight was found to be 2.63 kg, while the average pulse rate and respiratory rate were 100.62 per minute and 25.85 per minute, respectively. Hematological parameters revealed a mean hemoglobin level of 11.25 g/dL and platelet count of 3.18 lakh/cumm³, with mild anemia evident in many cases. The thyroid profile showed a markedly elevated mean TSH level of 63.41 mIU/L, confirming the hypothyroid status in the study group. The mean T4 level was 5.18 mcg/dL, while FT4 averaged at 0.77 ng/dL, reflecting varying degrees of hormone deficiency. FT3 and T3 levels also indicated hormonal imbalance but were available only in a subset of the patients. [Table 4]

Table 1: Clinico-Demographic Profile of Study Participants

Parameter	Category	Frequency	Percentage (%)
Age Group at Diagnosis			
	< 1 Year	14	17.5
	1–5 Years	13	16.3
	5–10 Years	24	30.0
	10–15 Years	18	22.5
	15–18 Years	11	13.8
Gender			
	Female	49	61.3
	Male	31	38.8
Type of Hypothyroidism			
	Congenital	35	43.8
	Acquired	45	56.3

Table 2: Birth Weight and Gestational Age Profile of Study Participants

Parameter	Category	Frequency	Percentage (%)
Birth Weight	< 2.0 kg	6	7.5
	2.0–2.5 kg	20	25.0
	2.5–3.0 kg	36	45.0
	≥ 3.0 kg	18	22.5
Small for Gestational Age (SGA)	Present	5	6.3
	Absent	75	93.8

Table 3: Nutritional and Anthropometric Z-Score Distribution of Study Participants

Parameter	Category	Frequency	Percentage (%)
Z Score Height-for-Age (HT)	< -3 SD	7	8.8
	-3 SD to -2 SD	20	25.0
	-2 SD to -1 SD	20	25.0
	-1 SD to 0	13	16.3
	0 to +1 SD	3	3.8
	+1 SD to +2 SD	15	18.8
	+2 SD to +3 SD	2	2.5
Z Score Weight-for-Age (WT)	< -3 SD	1	1.3
	-3 SD to -2 SD	21	26.3
	-2 SD to -1 SD	25	31.3
	-1 SD to 0	26	32.5
	0 to +1 SD	5	6.3
	+2 SD to +3 SD	2	2.5
Z Score BMI-for-Age (BMI)	-3 SD to -2 SD	4	7.5
	-2 SD to -1 SD	20	37.7
	-1 SD to 0	8	15.1
	0 to +1 SD	5	9.4
	+1 SD to +2 SD	14	26.4
	+2 SD to +3 SD	2	3.8
Z Score Weight-for-Height (WT/HT)	-3 SD to -2 SD	6	20.0
	-2 SD to -1 SD	6	20.0
	-1 SD to 0	18	60.0
Head Circumference (SD)	-2 to -3 SD	5	6.3
	-1 to 0 SD	17	21.3
	+1 to +2 SD	4	5.0
	+2 to +3 SD	1	1.3
	Not Assessed (NA)	53	66.3

Table 4: Mean and Standard Deviation of Clinical and Thyroid Profile Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Birth weight (Kg)	80	1.2	4.7	2.631	0.5238
Pulse (per min)	80	60	140	100.62	16.333
Respiratory rate (per min)	80	18	46	25.85	6.628
Hemoglobin (Hb)	80	8.6	14.8	11.254	1.3883
Packed Cell Volume (PCV)	80	31.2	42.0	35.513	2.0934
Mean Corpuscular Volume (MCV)	80	60.1	102.5	70.481	6.9906
Total Leukocyte Count (TLC)	80	86.74	14876.00	8450.02	2390.44
Platelets (cumm³)	80	1.70	4.20	3.1813	0.51311
Random Blood Sugar (RBS mg/dl)	80	86	170	103.66	11.268
T3 (ng/ml)	2	1.50	1.60	1.550	0.071
FT3 (ng/ml)	14	1.20	6.60	2.136	1.528
T4 (mcg/dl)	30	0.50	12.30	5.183	3.772
FT4 (ng/dl)	34	0.20	1.30	0.77	0.010
TSH (mIU/L)	80	9.86	400.00	63.413	61.975

DISCUSSION

Thyroid hormones are essential for fetal brain development, postnatal growth, and metabolic regulation. Their deficiency during critical developmental stages can lead to irreversible neurocognitive impairment and stunted growth.[6] The prevalence of thyroid dysfunction varies by gender, age, ethnicity, geographical factors, and iodine intake.[14] Despite implementation of the National Iodine Deficiency Diseases Control Program (NIDDCP), thyroid disorders remain prevalent in several regions of India.[15] Thyroid Research and Practice has emphasized including thyroid diseases in the list of non-communicable diseases of public health importance.[16]

In the current study involving 80 pediatric patients with hypothyroidism, the mean age of diagnosis was concentrated between 5–10 years (30%), suggesting delayed detection due to the lack of universal neonatal screening and low clinical suspicion. This finding aligns with Desai MP et al,[17] who reported that a significant number of congenital hypothyroidism (CH) cases are diagnosed after 3 months in the absence of screening programs. Joseph S et al,[18] also demonstrated that early diagnosis is more likely where awareness among clinicians is higher, reporting a mean age of 1.32 years with 44% diagnosed before 2 months of age.

The study showed a female predominance (61.3%), consistent with reports by Joseph S et al,[18] (59% females) and Engler D et al,[82] who observed a female-to-male ratio of approximately 2:1. This gender disparity aligns with the known higher incidence of autoimmune thyroid disorders in females. Similar ratios were also reported in studies by Desai MP et al,[17] Kapil U et al,[19] and Shah NA et al.[20] Hunter I et al,[21] from Scotland also reported a 1:2.8 female-to-male ratio in thyroid dysfunction in individuals under 22 years of age.

In terms of etiology, acquired hypothyroidism (56.3%) was more common than congenital

hypothyroidism (43.8%), differing from Joseph S et al. [18] who observed a higher incidence of CH (76.25%). Our results were similar to those of Singh A et al,[22] where primary hypothyroidism was dominant. The age distribution in our study, with most patients presenting after infancy, likely influenced this finding.

Regarding birth weight, 45% of the cohort had normal birth weight (2.5–3.0 kg), similar to Joseph S et al,[18] (60% normal birth weight) but higher than their reported 9.3% incidence of birth weight >3.5 kg. Desai MP et al,[17] reported 18% of patients with birth weight >3.5 kg, whereas Rees Smith B et al,[23] found 33% with birth weights >4 kg. These differences suggest that birth weight alone is not a reliable screening indicator for hypothyroidism.

In terms of clinical presentation, growth retardation (46.3%), lethargy (36.3%), and constipation (27.5%) were the most common findings. This pattern concurs with previous studies by Joseph S et al,[18] and Singh A et al,[22] where short stature and lethargy were reported as leading complaints. Notably, macroglossia—a classical sign of congenital hypothyroidism—was observed in only 6.2% of our cases, which is significantly lower than the 44.3% reported by Joseph S et al,[18] and 87% by Desai MP et al.[17]

Dry skin (31.3%), oedema (21.3%), and facial puffiness (26.3%) were frequent systemic signs, aligning with studies by Desai MP et al,[17] and Singh A et al.[22] Goiter (22.2%) was predominantly seen in acquired hypothyroidism, consistent with the autoimmune etiology in older children. These findings corroborate earlier data from Van Herle AJ et al,[24] and Morley JE et al,[25] who emphasized the variability in clinical signs between congenital and acquired forms.

Anthropometric assessments revealed that 33.8% of patients exhibited short stature (Z-score height < -2 SD), with 27.6% underweight. BMI Z-score indicated 37.7% within the -2 SD to -1 SD range, similar to the growth retardation findings in hypothyroid populations as discussed by Joseph S et al,[18] and Desai MP et al.[17] Microcephaly was observed in 2.5%, comparable to Joseph et al,[18] where 10% of patients with delayed diagnosis exhibited microcephaly.

Hematological findings in our cohort indicated mild anemia, with mean hemoglobin 11.25 g/dL. This aligns with observations by Banday TH et al,[26] who reported higher iron deficiency rates in hypothyroid patients. Erdem G et al,[27] and Ravanbod M et al,[28] have highlighted that correcting anemia in hypothyroidism requires concurrent thyroid hormone and iron supplementation for optimal results.

Thyroid function tests confirmed hypothyroid status with mean TSH 63.41 mIU/L, consistent with the elevated TSH levels reported by Joseph S et al,[18] where all congenital hypothyroid patients had raised TSH levels. Abnormal T4 and FT4 levels in our study reflect the hormonal imbalances typical in both congenital and acquired forms of hypothyroidism.

The assessment of bone age, though limited in our study, is recognized as an important marker of hypothyroidism severity and chronicity. Literature, including works by Stanbury JB et al,[29] and Fisher DA et al,[30] confirms that delayed bone age is a hallmark of hypothyroid children and correlates with disease duration.

Our findings on clinical features comparison align with those by Joseph S et al,[18] Desai MP et al,[17] and Singh A et al,[22] though variations were noted likely due to differences in study populations, age at diagnosis, and hospital-based sample bias. For instance, umbilical hernia, a common finding in earlier reports (Joseph S et al,[18]: 34%, Singh A et al,[22]: 10%, Ingbar SH et al,[31]: 58%), was absent in our cohort, suggesting variability in clinical expression.

The necessity for universal newborn screening has been reiterated by Kay C et al,[32] and Fisher DA et al,[30] emphasizing that clinical detection alone may miss early cases of congenital hypothyroidism. This study reinforces their conclusion, demonstrating the inadequacy of relying solely on clinical features without biochemical screening.

In summary, this study confirms the variability in clinical features and etiology of pediatric hypothyroidism, highlighting the predominance of acquired cases in our setting. The findings support the implementation of systematic growth monitoring, timely thyroid function testing, and early intervention strategies to reduce the burden of hypothyroidism-related complications in children.

CONCLUSION

The present study highlights the significant burden of delayed diagnosis in pediatric hypothyroidism, particularly in congenital cases where absence of classical features often leads to late detection. A clear female predominance was noted, with growth retardation, pallor, dry skin, and oedema being the most common clinical features. Birth weight was not found to be a reliable screening indicator. The study underscores the importance of high clinical suspicion, especially in children presenting with facial puffiness, poor scholastic performance, sleepiness, or goiter. Early diagnosis through routine growth monitoring and thyroid screening, along with increased awareness among primary care providers, remains essential to prevent irreversible complications and improve long-term outcomes. Hereby lies the importance of newborn screening for congenital hypothyroidism in all newborns to prevent permanent loss of IQ.

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