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Original Research Article

Role of technetium scan in diagnosis of congenital hypothyroidism

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ABSTRACT

Background: With advent of screening new born population the incidence of congenital hypothyroidism dropped to 1:3000 to 1:4000. We have aimed to show the importance of doing technetium scan to find out exact etiology of congenital hypothyroidism. It helps in proper treatment and explaining the long-term prognosis. However, many centres in India do not have facilities for nuclear study.
Methods: Study comprised of 30 children, the results of thyroid function test (TFT) were analysed, ultrasound neck was done to detect the presence or absence of thyroid gland in the neck and technetium scan was done in the department of nuclear medicine. Based on the images its classified as agenesis, ectopic or decreased uptake. The results of TFT, Ultrasound neck, technetium scan was analysed using statistical software.
Results: Correlation of thyroid profile with technetium scans, T3 was decreased in 61.5% cases of ectopic thyroid, 100% cases of thyroid agenesis and 83.3% cases of decreased uptake. T4 was decreased in 92.3% cases of ectopic thyroid, 80% cases of thyroid agenesis and 75% of decreased uptake. Whereas TSH increased in all the cases with abnormal Technetium scan results. Correlation of ultrasound neck with technetium scans revealed, of the nonvisualised thyroid gland by ultrasound, 13 were ectopic, 5 agenesis and 5decreased uptake. of the visualized thyroid gland, all the 07 showed decreased uptake.
Conclusions: Congenital hypothyroidism is one of the most serious condition needs to be diagnosed as early as in the newborn period.

Keywords: Congenital hypothyroididsm, Technetium scan, Thyroid function test, Ultrasound neck

INTRODUCTION

Congenital hypothyroidism (CH) is defined as thyroid hormone deficiency present at birth. Prior to the introduction of newborn screening programs, the incidence of congenital hypothyroidism, as diagnosed after clinical manifestations, was in the range of 1;7,000 to 1:10,000, with the advent of screening of newborn populations, the incidence was dropped to 1:3,000 to 1:4,000.[1,2] The clinical features of congenital hypothyroidism are often subtle and many newborn infants remain undiagnosed at birth, and this is due to passage of maternal thyroid hormone across the placenta, this provides a protective effect, especially to the growing fetal brain. Sometimes the congenital hypothyroidism has some moderately functioning thyroid tissue which also contributes to slow development of obvious clinical symptoms, and missing the diagnosis at the early infancy.[3] This led to most of the centres to implement the newborn screening to diagnose and to initiate early treatment and prevent the child from mental retardation.

Treatment of congenital hypothyroidism is based on serum thyroid function test results; however other diagnostic studies may be undertaken to determine an underlying exact aetiology. The other diagnostic studies may include technetium scan, thyroid ultrasonography, serum thyroglobulin (Tg) level, antithyroid antibody, and urinary iodine level. Technetium scan is one of the most accurate tests in diagnosing the exact aetiology of primary hypothyroidism, however many times it was not done due to financial strains as well as unavailability of facility to conduct the test in many centres.

METHODS

This prospective study was conducted at AJ Institute of Medical Sciences Hospital Mangalore, over the period of 2 years from November 2009 to October 2011. Study comprised of 30 children who were freshly detected cases of hypothyroidism below 1 year of age, prior to starting thyroxin and children above 3 years of age who were diagnosed congenital hypothyroidism during infancy. Children who were diagnosed by initial routine screening were subjected to repeat thyroid function test ultrasound neck and technetium scan. Children above 3 years included in this study were stopped thyroxin 4 months prior to conducting thyroid function test ultrasound neck and technetium scan. Children with metabolic, neurodegenerative, chromosomal and genetic disorders were not included in this study. Children above 1year and below 3 years who were diagnosed to have CH were excluded from the study. The results of TFT were analysed according to the standard age dependent normogram (compiled from Fisher DA, Vanderschuerem-Lodeweyeky M. Laboratory diagnosis in Infants and children). Ultrasound neck was done by the consultant radiologist to detect the presence or absence of thyroid gland in the neck. Technetium Scan was done in the department of nuclear medicine, 5 mci of 99m sodium pertechnatate was injected intravenously and 20 minutes later static images were obtained in anterior, left anterior oblique and right anterior oblique projections. Based on the images its classified as agenesis, ectopic or decreased uptake. The results of TFT, Ultrasound neck, technetium scan was analysed using statistical software.

RESULTS

Table 1: Age distribution of children studied.

Age in years	Number of children	%
<1 month	3	10.0
1-3 moths	11	36.6
3-6 months	8	27.7
6-12 months	8	27.7
Total	30	100%

Maximum number of patients presented between 1-3 months of age. Only 10% of patients presented below 1 month of age. Equal no. of patients presented between 3-6 months and 6-12 months of age.

Table 2: Gender distribution of children studied.

Gender	Number of children	%
Male	14	46.7
Female	16	53.3
Total	30	100

More number of females (53.3%) were affected compared to males.

The ratio was Female: male = 1.3:1.

Table 3: Thyroid profile of patients studied.

Thyroid profile of patients studied		Number of children (N=30)	%
T_3	Decreased	23	76.7
	Normal	07	23.3
T_4	Decreased	25	83.3
	Normal	05	16.7
TSH	Normal	0	0
	Increased	30	100.0

All patients had a high TSH value whereas 76.7% of patients had a low T_3 value and 83.3% of patients had a low T_4 value.

Table 4: Correlation of thyroid profile with technetium scan.

Thyroid profile		Technetium scan		
		Ectopic	Agenesis	Decreased uptake
T_3	Normal (7=23.3%)	5 (38.5%)	0 (0%)	2 (16.7%)
	Decreased (23=76.7%)	8 (61.5%)	5 (100%)	10 (83.3%)
T_4	Normal (5=16.7%)	1 (7.7%)	1 (20%)	3 (25%)
	Decreased (25=83.3%)	12 (92.3%)	4 (80%)	9 (75%)
TSH	Normal 0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Increased (30=100%)	13 (100%)	5 (100%)	12 (100%)

T_3 was decreased in 61.5% cases of ectopic thyroid, 100% cases of thyroid agenesis and 83.3% cases of decreased uptake.

T_4 was decreased in 92.3% cases of ectopic thyroid, 80% cases of thyroid agenesis and 75% of decreased uptake. Whereas TSH increased in all the cases with abnormal Technetium scan results.

TSH was high in all the cases of ectopic, agenesis and decreased uptake. Of the non-visualised thyroid gland by ultrasound, 13 were ectopic, 5 agenesis and 5 decreased uptakes. Of the visualized thyroid gland, all the 07 showed decreased uptake.

Table 5: Correlation of ultrasound neck with technetium scans.

Ultrasound neck	Total number of cases (n =30)	Technetium scan			P value
		Ectopic (n=13)	Agenesis (n=5)	Decreased uptake (n=12)	
Not visualized	23 (76.7%)	13 (100%)	5 (100%)	5 (41.7%)	<0.001
Visualised	7 (23.3%)	0 (0%)	0 (0%)	7 (58.3%)	

DISCUSSION

Our study confirmed the already known higher prevalence of CH among females than males. Lorey FW and Cunningham GC et al, had conducted a study in California and it was concluded that sex is the most important factor, with at least a 2:1 (female: male) ratio across all major ethnic groups.[4] However, it is still unclear why females are more susceptible to develop CH. In the present study, the numbers of females affected were more but the female: male ratio was 1.3:1. This was probably because of the lesser number of subjects that were included in our study.

Tahirovic H et al, conducted a study on clinical presentation of congenital hypothyroidism in which, of the 17 patients of CH, 10 (58.8%) were diagnosed in the first three months of life and 3 of them (17.6%) between fourth and sixth month of life, four children (23.5%) were diagnosed after the age of six months.[5] In our study the most common age group for manifestation of congenital hypothyroidism was 1-3 months followed by 3-6 months and 6-12 months. Only 3 children were detected below1 month of age. All the patients had high TSH, 76.7% patients had low T_3 and 83.3% had low T_4 level.

Iranpour et al, conducted a study on comparison of technetium scan study with T_4 and TSH values.[6] According to this study Thyroid scan was done in 116 CH patients of which 33 cases were thyroid agenesis, 7 cases were ectopic thyroid and 76 cases were found to be having normal thyroid scan results, whereas in our study all 30 cases of CH had abnormal technetium scan in which 13 were ectopic, 5 cases of agenesis and 12 cases of decreased uptake. Technetium scan in correlation with TSH, T_3 and T_4 had no significant P value.

J Perry et al, conducted a study on comparison of combined USG and Isotope scanning verses USG scanning alone concluded that Isotope scanning was superior to ultrasound in detection of ectopic tissue.[7] However ultrasound detected tissue that was not picked up by isotope scanning and also showed abnormalities of thyroid volume and morphology. So, in this study author clearly suggested that combination of USG neck and Isotope scan is more beneficial than Isotope scan alone. Muir et al, reported in their comparative study of ultrasound and radionuclide study in 50 cases of congenital hypothyroidism, in that none of the 13 ectopic thyroid tissues were detected with ultrasound and 4 cases of thyroid aplasia were detected as normal glands on ultrasound neck, and they concluded that ultrasound neck could not be the alternative to thyroid scintigraphy to define the cause of congenital hypothyroidism.[8]

In this study, out of 30 cases of CH, USG neck revealed 23 cases as non-visualized thyroid gland and in which technetium scan showed 13 cases of ectopic, 5 cases of agenesis and 5 cases of decreased uptake. Out of 7 cases of visualized glands by USG neck all had showed decreased uptake by Technetium scan. Comparing Technetium scan with ultrasound neck in identifying abnormalities in the thyroid gland, applying Chi square test, the calculated Sensitivity =60%, Specificity =82%, Positive predictive value =85%, Negative predictive value =50.4%. The calculated P value is <0.001 which is statistically strongly significant. Our study is more in favour of study done by Muir et al and several other studies where in USG neck is not an alternative to Technetium scan in diagnosing congenital hypothyroidism.

CONCLUSION

Congenital hypothyroidism is one of the most serious condition needs to be diagnosed as early as in the newborn period. Screening for CH is a routine protocol in the most of the centres however it is equally important to perform technetium scanning to see the exact aetiology of the CH, which helps in predicting the prognosis and planning long term management. It is also very clear that Ultrasound neck is not an alternative for Thyroid isotope scanning to define the aetiology of CH.

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