

# How widespread is Thyroid Disorders among Patients undergoing Coronary Artery Bypass Grafting? A Study from Tertiary Care Hospital

Richa Kahol<sup>1,2</sup>, Atul Kathait<sup>1\*</sup>, Sunil Kumar Mishra<sup>2</sup>, Anil Bhan<sup>3</sup>, Naresh Trehan<sup>3</sup>

## ABSTRACT

Coronary artery bypass grafting (CABG) is the most commonly performed cardiac procedure and thyroid disorders (hypothyroidism and hyperthyroidism) are the most widespread endocrine diseases. Till date, there is no Indian study pertaining to prevalence of thyroid disorders among subjects undergoing CABG. The aim of this study was to determine the prevalence of thyroid disorders among subjects undergoing CABG in a tertiary care hospital. This is a prospective observational hospital-based study having 560 subjects who underwent CABG. Pre-operative thyroid tests were conducted of all the subjects. On the basis of this test, subjects were divided into groups, "Euthyroid" (normal thyroid status) and Thyroid subjects, that is, Subclinical Hypothyroidism (SCHypo), Overt Hypothyroidism (OVHypo), Subclinical Hyperthyroidism (SCHyper), and Overt Hyperthyroidism (OVHyper), based on thyroid function test. The proportion of the disorders was calculated. The study population included 560 subjects (Males: 457 females: 103). The overall prevalence of thyroid function abnormalities was 41.07%. The SCHypo was the most pervasive thyroid disorder (33.75%), followed by SCHyper (4.28%), OVHypo (2.32%), and OVHyper (0.7%). Highest number of thyroid subject (57.8%) was in 40–59 age group and lowest (0.86%) in 18–39. Thyroid was more prevalent among females (45/103) than in males (185/457). Among subjects undergoing CABG, SCHypo was most common followed by SCHyper, OVHypo, and OVHyper. Among the subjects undergoing CABG, maximum thyroid cases are in the age group of 60–79 with female preponderance.

**Keywords:** CABG, CAD, CVD, Hyperthyroid, Hypothyroid

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## INTRODUCTION

Coronary artery bypass grafting (CABG) is the most accepted treatment method for treating multi-vessel coronary artery disease (CAD).<sup>[1]</sup> In the US, approximately 200,000 cases are performed annually.<sup>[2]</sup> Whereas, in the western European countries, its average incidence is reported around 62/100,000.<sup>[3]</sup> In India, about 1,40,000 CABG procedures are performed annually.<sup>[1]</sup> CABG procedures conducted in India are considered of high caliber due to its positive results.<sup>[4]</sup> Comorbidities that affect heart functioning include cardiovascular risk factors (diabetes, arterial hypertension, dyslipidemia, and renal failure) along with endocrine disorders, specifically thyroid.<sup>[5,6]</sup> Appropriate thyroid hormone level is mandatory for normal functioning of the heart.<sup>[7]</sup> Thyroid hormone is known to have a number of effects on the heart and any malfunctioning of this gland can lead to adverse effects,<sup>[8]</sup> even minor alterations in thyroid hormone synthesis and release can pose as a cardiovascular risk factor.<sup>[9]</sup>

CAD has become one of the most prevailing cardiac condition among South Asians.<sup>[10]</sup> Artherosclerosis is the main cause for CAD<sup>[11]</sup> and Overt Hypothyroidism (OVHypo) is a well-established factor for artherosclerotic cardiovascular disease. Hypothyroidism increases atherogenic low-density lipoproteins, alters coagulation ability, instills diastolic hypertension, and directly affects smooth muscle cells.<sup>[12]</sup> Subclinical hypothyroidism (SCHypo) influence clinical outcomes (mortality and morbidity) of subjects undergoing CABG, particularly when cardiovascular risk factors are high.<sup>[13]</sup> In case of hypothyroidism, heart ejects less amount of blood per heartbeat as it is unable to pump forcefully, this is because the heart muscles are weakened in both contraction and relaxation phase.<sup>[14]</sup> Diastolic dysfunction, bradycardia and pericardial effusion are some of the common manifestations of an untreated hypothyroidism.<sup>[15]</sup> On the other hand, tachycardia, widened pulse

<sup>1</sup>School of Biosciences, Apeejay Stya University, Gurugram, Haryana, India.

<sup>2</sup>Division of Endocrinology and Diabetes, Medanta The Medicity Hospital, Gurugram, Haryana, India.

<sup>3</sup>Department of Cardiothoracic and Vascular Surgery, Medanta The Medicity Hospital, Gurugram, Haryana, India.

**Corresponding Author:** Atul Kathait, School of Biosciences, Apeejay Stya University, Gurugram Haryana, India. E-mail: atul.kathait@asu.apeejay.edu

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pressure, increased cardiac output, and decreased total peripheral resistance are manifestations of hyperthyroidism.<sup>[16]</sup> Sub Clinical Hyperthyroidism (SCHyper) causes arrhythmia which, in turn, increases risk of acute heart failure.<sup>[17]</sup>

The prevalence and type of thyroid disorder depends on various factors such as age, ethnicity, geographical region, health status, health-care facilities, and medications in use.<sup>[18,19]</sup> India too incorporates high incidence of the disease, this is proven by a study conducted across eight cities of India by Unnikrishnan *et al.* where they demonstrated percentage prevalence of thyroid in 8 cities of India<sup>[20]</sup> (Ahmedabad 11.4% out of 377, Bangalore 10.03% of 867, Chennai 10.2% of 430, Delhi 11.42% of 1436, Goa 7.74% of 142, Hyderabad 9.3% of 383, Kolkata 22.7%, and Mumbai 10.48% of 1259). This alarming prevalence status has attracted attention of

medical fraternity worldwide.<sup>[21]</sup> Pre-screening of thyroid disorder is recommended prior to cardiac surgery because of the spurt in thyroid cases among subjects undergoing heart surgeries.<sup>[22]</sup> A study by Testini *et al.* states that prevalence of thyroid disorder in subjects with cardiac disease can be as high as 11.2%.<sup>[23]</sup> Some studies suggest that it may affect about 15% of adult female population and a smaller percentage of adult males.<sup>[24,25]</sup>

The number of publications on CABG in association with thyroid disorders remains low and more observational and outcome studies need to be carried out to validate.<sup>[1]</sup> There are many studies conducted in India time and again which provides an update on prevalence of thyroid in a particular region or state, but current study estimates the incidence of thyroid disorders among the subjects undergoing CABG. This study takes into account all four forms of thyroid disorder namely, SCHypo, OVHypo, SCHyper and Overt Hyperthyroidism (OVHyper). To know the disease burden, it is important to update our knowledge regarding the extent of disease spread; this study can provide an idea about the current scenario.

## Methods

This is a hospital-based cross-sectional observational study carried out in a tertiary care hospital, Medanta – The Medicity, Gurugram, Haryana, India. The study was reviewed and approved by Institutional Ethics Review Board (MICR-775/2017). Informed consent was obtained from each patient and the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution's human research committee. As a part of hospital protocol, some pre-operatives tests were conducted for all the subjects undergoing CABG. Therefore, no extra cost was incurred by the subjects.

Initially, all the subjects undergoing CABG surgery were enrolled in the study. Later, inclusion and exclusion criteria were applied. Finally, 560 subjects were selected. Subjects were categorized into two groups. Those having normal ranges of thyroid hormones (T3, T4, and TSH, T3: 1.23–3.23 nmol/L, and T4: 59–135 nmol/L TSH: 0.4–4.0 IU/ml) were categorized as "Euthyroid (Euthy)" group and the ones with deranged thyroid status were grouped as thyroid subjects. These thyroid subjects broadly categorized as hypothyroid (TSH > 4 IU/ml) and hyperthyroid (TSH < 0.5 IU/ml) depending on the biochemical test results. Subjects with deranged thyroid function were further classified as SCHypo/OVHypo and SCHyper/OVHyper, after confirmation from an endocrinologist.

## Statistical Analysis

Statistical analysis was carried out. Data were presented as mean  $\pm$  standard deviation. The prevalence of the disease was estimated as counts and percentages. It was represented as bar diagrams and Pie charts wherever applicable. Data were analyzed using MS Excel.

## Inclusion Criteria

- Subjects undergoing CABG who are above the age of 18 were included in the study.

## Exclusion Criteria

The following criteria were excluded from the study:

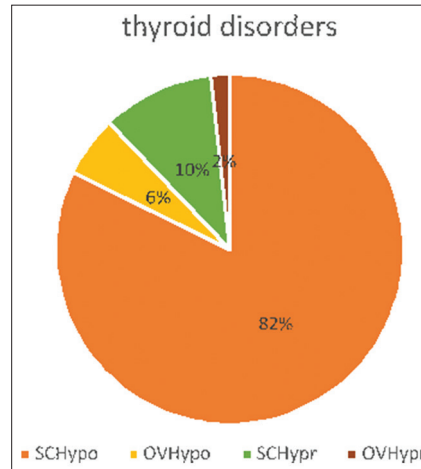
- Subjects other than Indian nationality.
- Subjects with decompensate liver failure, chronic kidney disease, and septicemia.
- Pregnant women.

## RESULTS

Initially 1500 consecutive subjects who underwent CABG surgery were enrolled in the study. After implication of the selection criteria, total 560 subjects were finally selected. Out of these, 330 (58.92%) were Euthy and 230 (41.07%) had disturbed thyroid hormone status. Out of thyroid subjects (230), 87.8% were detected hypothyroid ( $n = 202$ , 164 M and 38 F), and 12.1% were hyperthyroid ( $n = 28$ , 21 M and 7 F). Hypothyroid had higher prevalence than hyperthyroid amongst subjects undergoing CABG.

Subjects with disturbed thyroid status were segregated into four categories; SCHypo (33.75% overall prevalence), SCHyper (4.28% overall prevalence), OVHypo (2.32% overall prevalence), and OVHyper (0.7% overall prevalence). We observed that SCHypo was the most prevalent thyroid disorder, followed by SCHyper, OVHypo, and least prevalent was OVHyper. This prevalence pattern was similar in male and female subjects. In Figure 1, depicts a pie chart representation of each thyroid disorder.

The total proportion of males and females in the study is 457 (81.6%) and 103 (18.3%), respectively. Prevalence pattern of thyroid disorder is similar in males and females. Number of male and female subjects in each thyroid disorder category is given in Table 1. Even though, number of male subjects is higher in our study as CABG is more common among males, thyroid disorders were more prevalent among females (45/103; 43.68%) than in males (185/457;



**Figure 1:** Percentage distribution of thyroid disorder among patients undergoing CABG

**Table 1:** Gender-wise distribution of subjects categorized according to their thyroid status

Thyroid status	Male (457)		Female (103)	
	N	%	N	%
Euthyroid (330)	272	82.42	58	17.5
SCHypo <sup>a</sup> (189)	154	81.48	35	18.5
SCHyper <sup>b</sup> (24)	19	79.16	5	20.8
OVHypo <sup>c</sup> (13)	10	76.92	3	23.07
OVHyper <sup>d</sup> (4)	2	50	2	50

<sup>a</sup>Sub Clinical Hypothyroidism, <sup>b</sup>Sub Clinical Hyperthyroidism, <sup>c</sup>Overt Hypothyroidism, <sup>d</sup>Overt Hyperthyroidism

40.48%). A high prevalence of thyroid disorders, among subjects undergoing CABG was seen in the age group of 60–79 and the lowest prevalence was found in the age group of 18–39. Figure 2 shows a bar chart of subjects distributed age-wise according to categories of thyroid disorders Euthy, SCHypo, OVHypo, SCHyper, and OVHyper among subjects undergoing CABG.

### DISCUSSION

Alteration in thyroid status is known to have deleterious effects on heart.<sup>[26]</sup> Among the endocrine diseases associated with CABG, thyroid dysfunction accelerates the risk factors in multiple and complex ways.<sup>[27]</sup> Thyroid disorders are frequently observed endocrine disease in India and worldwide. In the present work, we determine the prevalence of thyroid disorders among the subjects undergoing CABG.

In the present study, we reported 41.07% of overall prevalence of thyroid disorder, this was similar to previously reported prevalence percentages such as 41.99%,<sup>[28]</sup> 40.36%,<sup>[29]</sup> and also 53% and 37%.<sup>[30]</sup> Few studies have also reported 16% prevalence rate for thyroid.<sup>[31]</sup> We observed that thyroid was more prevalent among females (43.68%) than in males (40.48%). Similarly, Jailkhani et al. reported 41.3% cases among females and 36.67% prevalence among males. Female preponderance was reported in many studies.<sup>[27-29,31-35]</sup> Results of current study as well as previous studies support the fact that hypothyroidism is more common in females.<sup>[36]</sup>

In most of studies the thyroid disorders were common in the age group between 20 and 45,<sup>[37,38]</sup> but we observed a higher proportion within 50–79. This variation may be due to the fact that we have included only those subjects who underwent CABG, which is more pervasive in higher age groups.

In the current study, overall prevalence of hypothyroid was found to be 36.07% which is closer to 38%<sup>[29]</sup> and also 43%.<sup>[39]</sup> The prevalence of hypothyroid may vary 1–38%.<sup>[40-42]</sup> Overall prevalence of hyperthyroid in our study constitutes 5% of the total population. This proportion was in accordance to a few studies from different

parts of India.<sup>[34,38,43]</sup> In Europe, prevalence of hyperthyroidism varies in between 0.3% and 5.3%.<sup>[44]</sup>

In the current study, overall prevalence of SCHypo is found to be 33.75%, which coincides with many studies.<sup>[29,36,45,46]</sup> In our study, SCHypo was common in the age group of 60–79 (57.6%, 109/189). Similar observations were reported in few studies<sup>[20,35]</sup> few studies reported lower age groups in this context.<sup>[37,43]</sup> We observed that SCHypo (93.5%) is more prevalent than OVHypo (6.43%) among hypothyroid subjects. This was a very common observation which was noted by a number of studies, for instance a study from Andhra Pradesh,<sup>[47]</sup> showed 86.53% of SCHypo and 13.46% OVHypo.<sup>[25,27,29,36,45,48]</sup>

Our overall prevalence for OVHypo was found to be 2.3% and its proportion among the other thyroid disorders is 5.6%. Some recent studies had similar observations.<sup>[29,35,45]</sup> Its prevalence may vary between 0.2% and 5.3% in Europe and 0.3% and 3.7% in the USA.<sup>[44]</sup> OVHypo was commonly observed within the age group 50–79 (61.5%). Various studies had reported different age groups for OVHypo such as 46–54<sup>[20]</sup> and 21–50.<sup>[35,45]</sup>

Our overall prevalence of SCHyper was 4.2% similar percentages such as 5.9% were reported in a study.<sup>[35]</sup> Different values such as 2.1% are also reported.<sup>[28]</sup> In general, SCHyper prevalence ranges between 1% and 5%.<sup>[44]</sup> Over all prevalence of OVHyper in our study is 0.7%, prevalence among thyroid disorders is 1.7%, and similar proportion of 1.63% is reported.<sup>[29]</sup> Here, overall prevalence of OVHyper is similar to Europe and the United States 0.7% versus 0.5% respectively. In Asia, the prevalence ranges in between 0.43% and 3.9% of the general population.<sup>[44]</sup> Similar prevalence percentages were reported from South India.<sup>[49,50]</sup> Hence, in our study, prevalence of SCHypo was found highest followed by SCHyper, OVHypo, and OVHyper.

### Study Limitation

This is a hospital-based study conducted in a tertiary care center; hence, the population may not be the appropriate representation

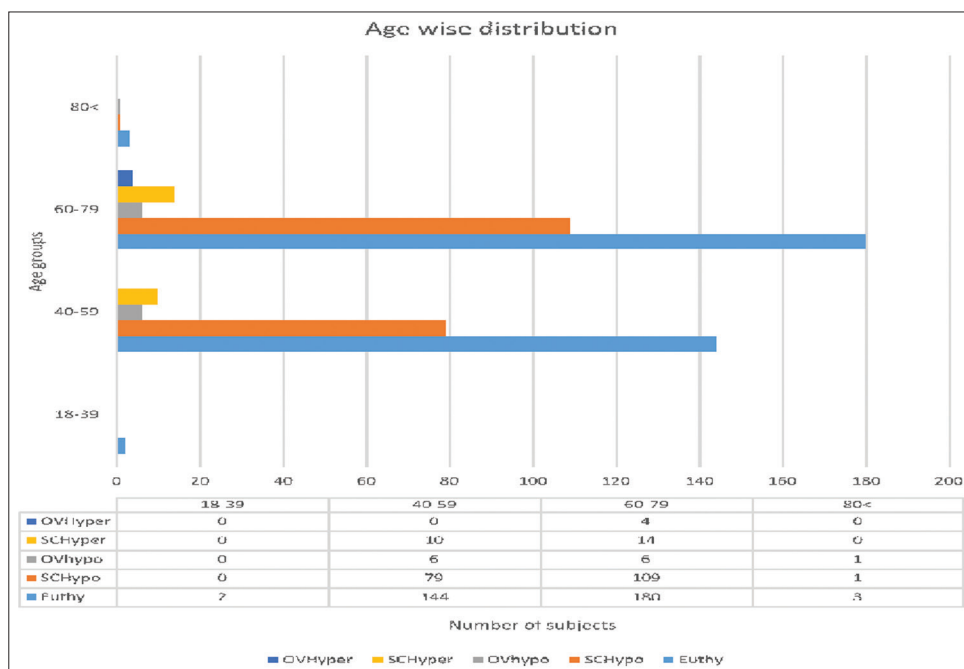


Figure 2: Distribution of Thyroid disorder in different age groups

of the entire populace. But can provide a general idea and can serve as a strong foundation for future large scale studies.

## CONCLUSION

This study was conducted to determine the prevalence of thyroid disorders among the subjects undergoing CABG in a tertiary care hospital. This is one of the first studies in this regard. Our findings indicate that among the CABG subjects hypothyroid is more prevalent than hyperthyroid. Among the thyroid disorders, SCHypo is the most prevalent, followed by SCHyper, OVHypo, and OVHyper. In gender-wise comparisons, females had higher prevalence of thyroid in comparison to male subjects. Thyroid was common in the age group of 60–79, this was followed by the age group 40–59. This pattern was similar in all the sub groups of thyroid disorder.

Since, it is a hospital-based study; it may not aptly represent the whole population. However, this can serve as a foundation for enhanced studies on a larger cross sectional populations that can be comparatively more helpful in understanding the disease pattern and distribution.

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