



Physiological Interactions between the Cardiovascular and Endocrine Systems: Hyperthyroidism and Pulmonary Hypertension

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Abstract:

Pulmonary hypertension is defined as the mean arterial pressure greater than 20 mmHg. Thyroid disorders may induce systemic manifestations of pulmonary hypertension (PH), physiological causes of which are not well understood. PH can be caused by a number of conditions, including HIV, connective tissue disorders, hypoxic chronic lung diseases, chronic thromboembolism, and left heart problems. Pulmonary hypertension secondary to Thyroid disorder is rare. Here we report a case of pulmonary hypertension caused by grave's disease which emphasize the fact that physicians considering thyroid disorders causing pulmonary hypertension plays a pivotal role in reducing mortality and morbidity.

Introduction

Pulmonary hypertension (PH) is defined as the mean pulmonary arterial pressure greater than 20 mmHg¹; it requires a high degree of suspicion for diagnosis because of no specific signs and symptoms and low prevalence. Dyspnea on exertion, lower limb edema, hepatomegaly and syncope are commonly associated signs and symptoms of pulmonary hypertension². Various conditions like left heart diseases, hypoxic chronic lung diseases, chronic thromboembolism, connective tissue diseases, hereditary diseases, HIV can cause PH¹. Thyroid diseases causing pulmonary hypertension is a result of systemic manifestations of which the physiological mechanisms are unclear³.

Thyroid hormone effects the cardiovascular system due to 1) interactions with autonomic nervous system, 2) effect on vascular bed and endothelial function, 3) direct effect on cardiac tissues⁴. Hyper or Hypo thyroid levels exacerbate these effects. Thyroid hormone modulates the peripheral vascular tone by interfering in the biochemical cascade of the beta-adrenergic biochemical pathways. It has positive chronotropic and inotropic effect on myocardial contraction.

Thyroid functional status influences the vascular tone by interfering with the alpha 1 adrenergic stimulation, it also alters the vascular wall morphology. Pulmonary vascular bed can be considered as a possible final target of these cardiac and vascular alterations. We present a case of Pulmonary hypertension caused by graves' disease.

Case Details

A 57-year-old female presented to the hospital with chief complaints of breathlessness which was grade III MMRC since 1 week. Patient had no other significant clinical history. On examination patient's vitals were stable and normal systemic examination. Routine blood investigations were normal.

2D ECHO was done and it showed normal Left ventricle systolic function, ejection fraction 60% with moderate pulmonary hypertension (RVSP = 51mmhg). CT Thorax was done and it showed prominent main pulmonary artery and its branches with diffuse mosaic attenuation in bilateral lung fields, mild cardiomegaly and bilateral pleural effusion. Evaluation for pulmonary hypertension was done. D-dimer was 1.46 micro gram /ml. CT pulmonary angiogram was done and it showed no evidence of pulmonary thromboembolism. Anti-nuclear antibody (immunofluorescence) was negative. Thyroid profile was done and it showed TSH < 0.01 m IU/L free T3 11.6 pg/mL freeT4 4.7 ng/dL and anti-thyroid peroxidase >1000 IU/ml. Ultrasound of thyroid showed bilateral lobes of thyroid appearing bulky, heterogenous with increased with vascularity. Patient was diagnosed to have Grave's disease and patient was started on oral carbimazole 5 mg twice a day.

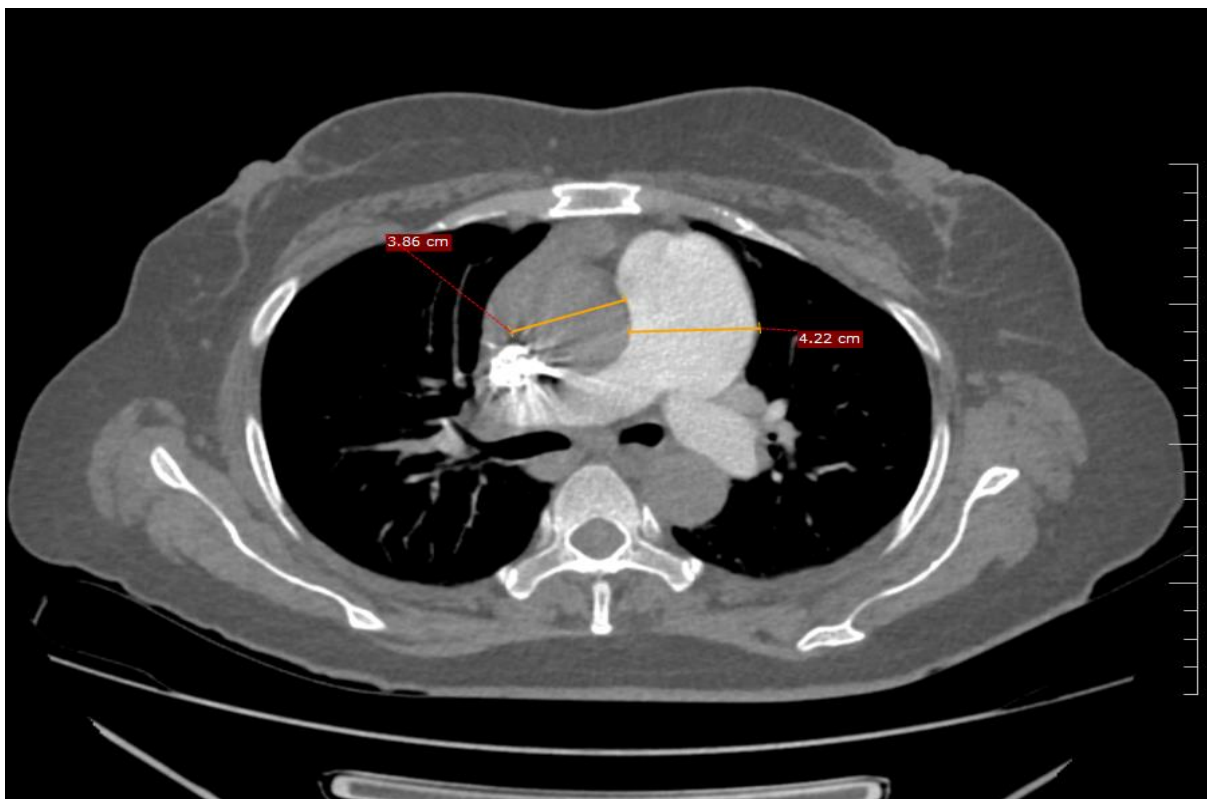


Fig 1: Ct Chest Showing Dilated Main Pulmonary Artery With Reversal Of Aorta Pulmonary Ratio

Discussion

Pulmonary Hypertension is classified based on etiological and pathophysiological mechanisms into 5 groups. Group 1) idiopathic pulmonary artery hypertension, Group 2) because of left heart diseases, Group 3) due to hypoxia and chronic lung disease, Group 4) CTEPH, Group 5) due to unknown mechanisms⁵. The possibilities of group 2, group 3, group 4 in this case were ruled out with normal CTPA, normal left ventricular function and no prior history of lung conditions hypoxia. Due to hyperthyroidism in our patient, we classified it as group 5 which is associated with metabolic disorders.

Majority of the hyperthyroid cases up to 80% are due to graves' disease. The cardiovascular effect of thyrotoxicosis has been well documented in many studies. The association between PH and hyperthyroidism can be either etiological or incidental. No clear pathogenetic mechanisms have been described. Few hypotheses have been proposed of which the main one is the autoimmune hypothesis⁶. It describes the possible indirect influence of thyroid stimulating hormone receptor antibodies in inducing an immune mediated damage of the vascular endothelium which promotes endothelial dysfunction and develops PH. All patients with graves' disease do not develop PH so few other mechanisms also have been described which are not in the scope of our discussion.

Few studies describing the prevalence of hyperthyroidism and pulmonary hypertension are SUE et al described 47% of pulmonary hypertension in the study population of 75 patients with hyperthyroidism⁷. Marvisi et al reported 35% mild PH in patients suffering with grave's disease and multinodular goiter⁸. A study by Trapp et al found that the combination of PH hyperthyroidism might induce acute cardiopulmonary decompensation decreasing the patient's survival, this also signifies the importance of aggressive treatment of hyperthyroidism either pharmacologically or surgically to improve patient's survival⁹. Hypothyroidism also causes pulmonary hypertension and the prevalence have been reported at 24% in few studies¹⁰.

There are no prospective studies for the treatment of PH due to hyperthyroidism. Few studies and case reports showed significant reduction in pulmonary artery pressure with thyroid suppression drugs suggesting their role in improving the hemodynamic status of patients¹¹. Our case responded well to anti thyroid suppression drugs and clinical symptoms came down.

Conclusion

Pulmonary hypertension group 5 needs extensive evaluation due to its wide range of etiological factors and so strong suspicion is needed. As both hyper and hypo thyroid levels are known to cause pulmonary hypertension a routine thyroid investigation is a mandatory part of pulmonary hypertension evaluation

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