

Evaluation of Size of Thymus and its Relationship with CT Severity Score in Patients having CT Signs for COVID 19 Virus Disease in the Age Group of 20-40 Years: A Study of 100 Cases

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Abstract: Aims: To measure the size of thymus and find the relationship of thymus gland enlargement with CT severity score on computed tomography. Methods and Material: In this study, we have collected computed tomography scans of 100 patients who showed CT signs for COVID 19 virus disease (CORADS 5). The age group for cases included in our study was 20-40 years. Statistical analysis used: Chi square test. Results: In a study of 100 cases, we found that there is a significant association between size of left lobe of thymus and CT severity score. Conclusion: In COVID 19 patients, thymus enlargement was frequent with patients having higher CT severity score. This may be due to increased T lymphocytes production that appears due to virus induced lymphopenia. Thus we know a relationship between increased thymus size and increased CT severity score in COVID 19 virus disease patients.

Keywords: Thymus, CT severity score, COVID-19

Key Messages: In COVID 19 patients, thymus enlargement was frequent with patients having higher CT severity score.

1. Introduction

The thymus demonstrates a unique morphological change over time in its size, shape, and density according to age. The thymic gland reaches its maximum size at puberty and eventually undergoes “involution”, a gradual decrease in size with replacement of fatty tissues.^{1,2}

At CT, the thymus appears as a bilobed triangular structure located in the anterior mediastinum, most commonly anterior to the proximal ascending aorta, the pulmonary outflow tract, and the distal superior vena cava before it enters the right atrium.³

Baron et al³ analyzed 154 mediastinal CT scans and reported that the mean thickness of a normal thymus decreased with advancing age from 1.1 cm (standard deviation, 0.4 cm) for the 6–19-year age group to 0.5 cm (standard deviation, 0.27 cm) for patients over age 50 years. The maximum thickness was 1.8 cm in patients under age 20 years and 1.3 cm in patients over age 20 years.

The thymus is a largely neglected organ but plays a significant role in the regulation of adaptive immune responses. The effect of aging on the thymus and immune senescence is well established, and the resulting inflammaging is found to be implicated in the development of many chronic diseases including atherosclerosis, hypertension and type 2 diabetes. Both aging and diseases of inflammaging are associated with severe COVID-19 disease.

Our aim and objective in the study was to measure the size of thymus and find the relationship of thymus gland

enlargement with CT severity score on computed tomography.

2. Subjects and Methods

The study was performed on 100 cases having CT signs for COVID 19 virus disease (CORADS 5) at Department of Radiodiagnosis, GAIMS, Bhuj, Kutch over a period of 2 months using convenient sampling.

The CT scan was performed on 16 slice SIEMENS SOMATOME SCOPE machine.

The age group for cases included in our study was 20-40 years of both genders.

The size of left and right lobes of thymus was measured on axial images on mediastinal window.

CORADS score was calculated on axial and coronal reformatted images on pulmonary window.

The cutoff for width of thymus was considered 13 mm.

Then we found the relationship of size of thymus with the CT severity score of the cases. We divided that into 3 subdivisions: CT severity score less than 5, between 5 to 15 and more than 15.

The data was then analysed using MsExcel using appropriate statistical test.

3. Results

In this study, we found that males (71) were more in number as compared to females(29).

The number of cases having a CT severity score below 5 were 55.

37 cases were having a CT severity score between 5 to 15 and cases with CT severity more than 15 were 8 in number.

CT severity score	Number	Frequency
Less than 5	55	55
5-15	37	37
More than 5	8	8

Size of right lobe of thymus	Less than 5	5-15	More than 5
Less than or equal to 13 mm (normal)	54	33	8
More than 13 mm (enlarged)	1	4	0

Chi square value: 4.22, p value: 0.12

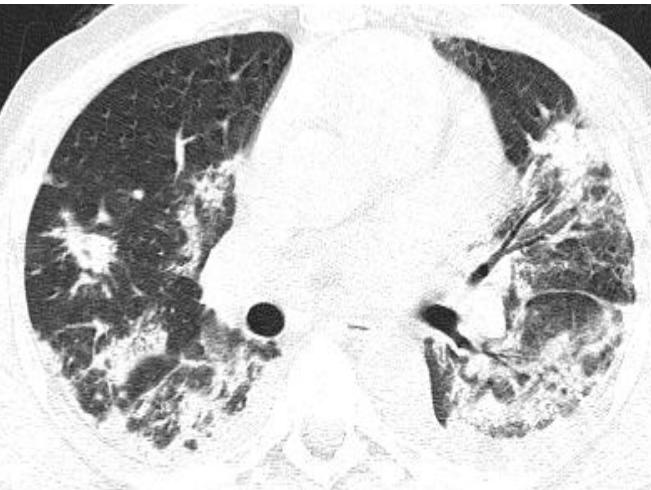
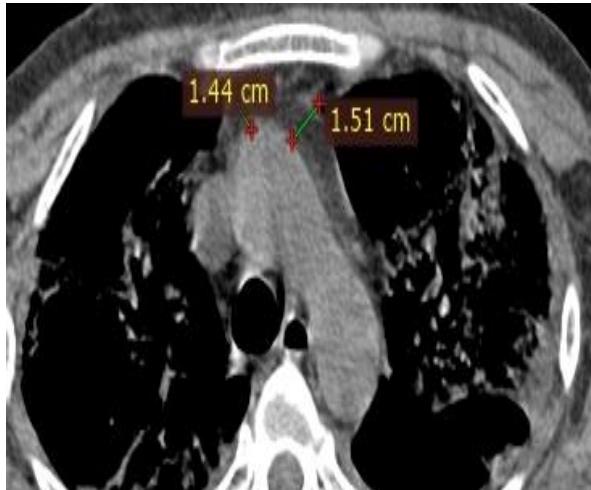
Not significant

Size of right lobe of thymus	Less than 5	5-15	More than 5
Less than or equal to 13 mm (normal)	49	25	4
More than 13 mm (enlarged)	6	12	4

Chi square value: 9.9, p value: 0.006

Significant

38 year old male, CT severity score 19, thymus enlarged
(Right lobe measures 14 mm and left lobe measures 15 mm)



28 years old male, CT severity 12, left lobe of thymus 13 mm.



In a study of 100 cases, we found that there is a significant association between size of left lobe of thymus and CT severity score, with a chi square p value of 0.006.

However, no association was found between the size of right lobe of thymus and CT severity score, with a chi square p value of 0.12.

4. Discussion

Thymus gland is target organ for various infectious diseases.

Clinically, patients with true thymic hyperplasia can be divided into three groups:

- Those without a related preexisting condition;
- Those recovering from a recent stress event such as pneumonia, corticosteroid therapy, radiation therapy, chemotherapy, surgery, or burns; and

- Those with other disorders such as hyperthyroidism, sarcoidosis, or red blood cell aplasia.^{4,5}

In a study conducted by Cuvelier et al, Eighty-seven patients were studied: 50 COVID patients and 37 controls. Non-atrophic or enlarged thymus was more frequent in COVID patients than in controls (66% vs. 24%, p<0.0001). Thymus enlargement in COVID patients was associated with more extensive pulmonary involvement score on CT-scans

The loss of thymic reactivation might contribute to worse prognosis.⁶

In COVID 19 patients, thymus enlargement was frequent with patients having higher CT severity score. This is associated with increased T lymphocytes production that appears due to virus induced lymphopenia.⁶

Thus we know a relationship between increased thymus size and increased CT severity score in COVID 19 virus disease patients.

References

- [1] Nishino M, Ashiku SK, Kocher ON, Thurer RL, Boiselle PM, Hatabu H. The Thymus: A Comprehensive Review. Radiographics. 2006; 26(2): 335–48.
- [2] Suster S, Rosai J. Histology of the normal thymus. Am J Surg Pathol. 1990; 14(3):284–303.
- [3] BaronRL, Lee JK, Sagel SS, Peterson RR. Computed tomography of the normal thymus. Radiology1982; 142:121–125.
- [4] ShimosatoY, Mukai K.Tumors of the mediastinum. Washington, DC: Armed Forces Institute of Pathology, 1997.
- [5] Webb RW. The mediastinum: mediastinal masses. In: Webb RW, Higgins C, eds. Thoracic imaging:pulmonary and cardiovascular radiology. Phila- delphia, Pa: Lippincott Williams & Wilkins, 2005; 212–270
- [6] Cuvelier P, Roux H, Couëdel-Courteille A, Naudin C, De Muylde BC, Cheynier R, Squara P, Marullo S. Protective Reactive Thymus Hyperplasia in the COVID-19 Acute Respiratory Distress Syndrome.
- [7] Awulachew E, Diriba K, Anja A, Getu E, Belayneh F. Computed tomography (CT) imaging features of patients with COVID-19: Systematic review and meta-analysis. Radiology Research and Practice. 2020 Jul 23;2020.
- [8] Nasseri F, Eftekhari F. Clinical and radiologic review of the normal and abnormal thymus: pearls and pitfalls. Radiographics. 2010 Mar;30(2):413-28.
- [9] Araki T, Sholl LM, Gerbaudo VH, Hatabu H, Nishino M. Imaging characteristics of pathologically proven thymic hyperplasia: identifying features that can differentiate true from lymphoid hyperplasia. American Journal of Roentgenology. 2014 Mar; 202(3):471-8.
- [10] Kellogg C, Equils O. The role of the thymus in COVID-19 disease severity: implications for antibody treatment and immunization. Human Vaccines & Immunotherapeutics. 2020 Oct 2:1-6.
- [11] Güneş H, Dinçer S, Acıpayam C, Yurtutan S, Özkarş MY. What chances do children have against COVID-19? Is the answer hidden within the thymus? European journal of pediatrics. 2020 Oct 13:1-4.
- [12] Sabri YY, Fawzi MM, Nossair EZ, El-Mandooh SM, Hegazy AA, Tadros SF. CT findings of 795 COVID-19 positive cases: a multicenter study in Egypt. Egyptian Journal of Radiology and Nuclear Medicine. 2020 Dec; 51(1):1-9.