

## Low T3 syndrome and cardiac function in patients hospitalized due to acute heart failure

 Viktor Čulić<sup>1,2\*</sup>,  
 Ivan Velat<sup>2</sup>,  
 Željko Bušić<sup>2</sup>,

<sup>1</sup>University Hospital Centre Split, Split, Croatia

<sup>2</sup>University of Split School of Medicine, Split, Croatia

**KEYWORDS:** heart failure, left ventricular diastolic function, left ventricular ejection fraction, low triiodothyronine syndrome.

**CITATION:** *Cardiol Croat.* 2025;20(5-6):106. | <https://doi.org/10.15836/ccar2025.106>

**\*ADDRESS FOR CORRESPONDENCE:** Viktor Čulić, Klinički bolnički centar Split, Šoltanska 1, HR-21000 Split, Croatia. / Phone: +385-21-55-72-89 / Fax: +385-21-55-76-20 / E-mail: [viktor.culic@st.t-com.hr](mailto:viktor.culic@st.t-com.hr)

**ORCID:** Viktor Čulić, <https://orcid.org/0000-0002-4026-0195> • Ivan Velat, <https://orcid.org/0000-0002-5757-3016>  
Željko Bušić, <https://orcid.org/0000-0001-5877-3602>

**Introduction:** Low triiodothyronine syndrome (LT3), also referred to as sick euthyroid syndrome or non-thyroidal illness syndrome, is commonly defined as a low serum level of free triiodothyronine without a coexisting increase in serum free thyroxine and thyroid-stimulating hormone levels<sup>1</sup>. Thyroid dysfunction and alterations in thyroid hormone concentrations can affect the cardiovascular system and lead to cardiovascular disease. Vice versa, cardiovascular diseases such as acute myocarditis, myocardial infarction, heart failure (HF) and acute ischemic stroke, may disturb the levels of thyroid hormones, particularly LT3, which further increases the risk of morbidity and mortality indicating a poor prognosis in such patients<sup>2,3</sup>. In patients with hypertrophic cardiomyopathy, LT3 has been associated with an increased risk of HF worsening or sudden cardiac death<sup>4</sup>.

**Patients and Methods:** Demographic characteristics, cardiovascular risk factors, previous medical therapy, laboratory findings including serum concentrations of thyroid hormones and echocardiographic parameters were prospectively collected for consecutive patients hospitalized for acute HF. The left ventricular (LV) ejection fraction (LVEF) and LV diastolic dysfunction (LVDD; 3 grades) were assessed in accordance with the current guidelines.

**Results:** The study included 303 patients. The mean age of the study population were 72.4±9.4 years, there was 33% women, 14.5% smokers, 62.7% hypertensive patients, 46.5% patients with diabetes, 30.7% with hypercholesterolemia, 22.4% with previous myocardial infarction and 40.5% those with LT3. The mean LVEF was 47.8±13.3%, median LVDD was grade 3 (interquartile range 2–3). Patients with LT3 were older than those without LT3 (73.2±7.1 years vs. 76.1±8.7 years;  $t=2.28$ ,  $p=0.022$ ). The frequency of LT3 did not differ according to sex ( $x=1.243$ ,  $p=0.218$ ), smoking ( $x=0.001$ ,  $p=0.996$ ), hypertension ( $x=0.584$ ,  $p=0.442$ ) diabetes mellitus ( $x=1.131$ ,  $p=0.304$ ), hypercholesterolemia ( $x=0.762$ ,  $p=0.412$ ) or previous myocardial infarction ( $x=0.875$ ,  $p=0.267$ ). In the multivariable analysis, which included adjustment for the aforementioned clinical covariates, LT3 showed an independent predictive association for both low LVEF ( $\beta=-0.181$ ,  $p=0.017$ ) and higher LVDD ( $\beta=0.194$ ,  $p=0.011$ ).

**Conclusions:** The present study suggests that LT3 is an independent predictor of lower LVEF and more progressed LVDD in patients with HF. There is a need for further research of biological mechanisms and therapeutic possibilities of LT3.

RECEIVED:  
February 28, 2025

ACCEPTED:  
April 2, 2025



### LITERATURE

1. Fliers E, Bianco AC, Langouche L, Boelen A. Thyroid function in critically ill patients. *Lancet Diabetes Endocrinol.* 2015 Oct;3(10):816-25. [https://doi.org/10.1016/S2213-8587\(15\)00225-9](https://doi.org/10.1016/S2213-8587(15)00225-9)
2. Razvi S, Jabbar A, Pingitore A, Danzi S, Biondi B, Klein I, Peeters R, Zaman A, Iervasi G. Thyroid Hormones and Cardiovascular Function and Diseases. *J Am Coll Cardiol.* 2018 Apr 24;71(16):1781-1796. <https://doi.org/10.1016/j.jacc.2018.02.045>
3. Selmer C, Olesen JB, Hansen ML, von Kappelgaard LM, Madsen JC, Hansen PR, Pedersen OD, Faber J, Torp-Pedersen C, Gislason GH. Subclinical and overt thyroid dysfunction and risk of all-cause mortality and cardiovascular events: a large population study. *J Clin Endocrinol Metab.* 2014 Jul;99(7):2372-82. <https://doi.org/10.1210/jc.2013-4184>
4. He CJ, Zhu CY, Fan HY, Qian YZ, Zhai CL, Hu HL. Low T3 syndrome predicts more adverse events in patients with hypertrophic cardiomyopathy. *Clin Cardiol.* 2023 Dec;46(12):1569-1577. <https://doi.org/10.1002/clc.24156>