Relative Effects of Enhanced External Counter Pulsation Therapy on Thyroid Hormones in Heart Failure Treatment

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Abstract

Background and Objectives:
Thyroid hormone and its metabolism have been shown to be abnormal in patients with non-thyroidal illnesses such as those with advanced heart failure. Free T3/Reverse T3 ratio is believed to be associated with a reduced ejection fraction and poor short-term outcomes in patients with advanced heart failure. We sought to evaluate the effects of Enhanced External Counter Pulsation Therapy (EECP) on the thyroid hormone profile of heart failure patients.

Methods:
Our study group consisted of 30 patients referred for the management of heart failure. Each patient underwent treatment by EECP, and free Triiodothyronine (T3) level alterations were monitored before the commencement of treatment and once again after the completion of standard EECP treatment.

Results:
Thirty patients with advanced heart failure symptoms at a median age of 65 (46-77) years were enrolled. After EECP therapy, the ejection fraction was improved significantly. The median ejection fraction after EECP treatment was 46.5% (p value <0.001). T3 levels increased to 4.01 +/-1.46 (ng/dl); this, however, was not a significant finding (p value =0.44).

Conclusion:
Treatment of heart failure by EECP may have some effects on thyroid hormone milieu and metabolism insofar as T3 levels rose after EECP in our study, although this effect was not statistically significant. More thorough investigations are needed before any conclusion could be made on this matter. ***(Iranian Heart Journal 2012; 13(2):35-39).***

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Introduction

Thyroid hormone milieu has been shown to be abnormal in non-thyroidal illnesses, and low Triiodothyronine (T3), elevated reverse T3, and abnormal thyroid stimulating hormone (TSH) manifest this. (1) Some studies have shown that thyroid hormone metabolism is specially altered in patients with advanced heart failure and there are some special characteristics to it, which are different from those of other non-thyroidal diseases. In patients with heart failure, the free T4 index level is preserved, but the free T3 index is often low and the reverse T3 level is increased. (2)

It has been shown that the free T3 index/reverse T3 ratio is associated with a lower ejection fraction (EF), higher filling pressures, lower serum sodium, and worse nutritional status. It is one of the most important markers of a poor short-term outcome in patients with severe heart failure. (2, 6) Studies have also demonstrated that thyroid hormone metabolism and especially the free T3 index/reverse T3 ratio will improve after cardiopulmonary bypass. (3, 4) Low T3 levels are strong prognostic predictors in patients with heart failure and these levels are associated with a lower EF (2, 6); consequently, some studies have even suggested using thyroid hormones in heart failure patients as well as patients undergoing cardiac surgeries. (5)

Enhanced External Counter Pulsation Therapy (EECP) is a procedure that has a proven role in patients with angina and some studies have reported its role as a therapeutic assistant in heart failure syndromes. It potentially has desirable effects by mechanisms like milking action and increased flow to the heart from limbs; and at deflection point, it may have a suctioning effect on the blood and help the wounded heart muscle to pump the blood into the peripheral organs. (8)

There is doubt as to whether thyroid hormone levels are affected by heart failure per se and whether heart failure treatment by EECP will improve these indices. The current study aimed to evaluate the effects of EECP on thyroid hormone levels.

Material and Methods

Our study group was comprised of 30 patients with congestive heart failure on standard approved therapy based on the current heart failure guidelines that were referred to Day General Hospital for EECP treatment. The mean EF of the patients was 33.3%. Primary thyroid dysfunction was ruled out in all of these patients via the serologic screening test at the beginning of the study. Patients with primary thyroid dysfunction or a previous history of thyroid illness as well as patients on medications affecting thyroid function tests and patients who were not candidates for EECP were excluded from the study.

Each patient's baseline T3 level was measured before the commencement of EECP sessions. EECP was used to treat heart failure via a standard protocol, consisting of 35 one-hour sessions in a 7-week period. The EF was measured with 2D echocardiography in each patient by the same cardiologist at the beginning and at the completion of the treatment. Free T3 levels before and after EECP were measured and

compared. The patients were also evaluated for any situation effecting thyroid hormones such as drugs usage, past history of thyroid illness, and diabetes.

Only patients who were candidates for EECP in the course of their heart failure treatment were enrolled in the study and no unnecessary intervention was done.

Statistical and Data Analysis

Data analysis was done using SPSS statistical software (version 12). A paired *t*-test was used to evaluate alterations in the EF and free T3 levels before and after EECP sessions.

Results

Thirty patients with heart failure syndrome who were under treatment with standard heart failure therapies and were candidates for EECP treatment by their cardiologist as a secondary measure to help optimize their treatment were included in the present study. The study population comprised 24 males and 6 females at a mean age of 65 (46-77) years. The median EF of the patients was 33% (11-56%) at the beginning of the study. The mean T3 level at the initiation of the treatment was 3.76 +/-1.38 (ng/dl).

After 35 one-hour sessions of EECP treatment in a 7-week period, the mean EF of the patients was improved to 46.5%, which was significant (p value =0.001). The EF before and after treatment in each patient had a positive correlation with the final outcome, and the patients whose primary EF was higher at baseline had more improvement in their EF.

Before EECP commencement, 14 patients had severe systolic dysfunction (defined as EF <30%). After EECP treatment, the number of these patients was reduced to 7. The T3 level also increased from 3.76 +/-1.38 to 4.01 +/-1.46 (ng/dl) (p value =0.44), which was statistically insignificant (Table 1).

There was no significant relation between diabetes mellitus or hypertension and the rise in thyroid hormone levels.

Pre-treatment EF	Post-treatment EF	Pre-treatment T3	Post-treatment T3
33% (11-56%)	46.5%	3.76+/-1.38	4.01+/-1.46

Table 1: Ejection fraction (EF) and T3 levels before and after treatment with EECP

Discussion

Thyroid hormone metabolism is thought to be abnormal in non-thyroidal illnesses and it is manifested by low T3, elevated reverse T3, and abnormal TSH. (1) Furthermore, serum T3 correlates best with the severity of the illness. (7) One of the most important chronic illnesses associated with thyroid hormone dysfunction is advanced heart failure (2) and this condition may have some special characteristics with respect to its relation with thyroid hormones. These features include preserved T4 levels, low free T3 index levels, and high reverse T3 levels. Now we know that an impaired thyroid hormone function and metabolism is associated with a poorer short-term outcome in patients suffering from heart failure (2, 6) and it has been proven that low T3 syndrome is a strong prognostic predictor in heart failure patients and correlates with higher mortality rates. (2, 6)

The question, which we are facing here, is that whether or not thyroid metabolism is affected by improvement in the EF and heart failure syndrome after successful treatment. Some studies have shown that the answer to this question is in the affirmative, especially after cardiac bypass surgery. (3, 4) On the other hand, some studies have suggested using thyroid hormones in these patients and in those who undergo cardiac surgery (5) because low T3 levels are associated with a lower EF and cardiac death. (2, 6)

There are reports that heart failure treatment improves thyroid hormone metabolism. Therefore, our assumption was that EECP would augment thyroid function tests as well and this would be achieved by an increase in the EF. Be that as it may, as it is evident from our results, we found no significant changes in thyroid hormone levels. This may be due to a number of reasons, first and foremost among which is that the degree of improvement in the EF by EECP is not sufficient enough to induce changes in thyroid hormone levels. However, our study showed that EECP improved heart failure significantly inasmuch as our patients' EF was increased significantly, but its effect may have some special aspects to it that are not considered in our study. One other limiting factor in our study was the relatively small size of our study population, which precluded a thorough assessment of the effects of improvement in heart failure on thyroid hormone levels.

Nonetheless, we should take into account that improvement in heart failure syndrome with therapy and the absence of a significant change in thyroid hormone levels is not a direct surrogate marker for a low cardiac performance. We would, therefore, recommend that this study be repeated with a larger patient group, ensuring that all confounding factors are considered.

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