**Original article**

# Assessment of Sympathetic Function in Rheumatoid Arthritis patients using Sustained Hand Grip Test and Cold Pressor Test

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**Abstract**

**Background:** Rheumatoid Arthritis (RA) is a chronic inflammatory disorder affecting primarily the peripheral joints. This disorder not only affects the joints but also many systems like the Respiratory, Cardiovascular and the Nervous system particularly autonomic nervous system involvement has been commonly encountered among the RA patients.This autonomic dysfunction greatly affects theirquality of life.

**Aims and objectives**: The study was conducted to assess the cardiovascular sympathetic function among RA patients. This study also analyzed the correlation of sympathetic function with age, gender, disease duration and RF factor positivity.

**Methods**: This cross sectional study was conducted in a tertiary care hospital among 200 RA patients aged 22-55 years attending the Rheumatology clinic. Age matched control group included 100 persons. Two non-invasive tests were used to assess the sympathetic function namely the Sustained Hand Grip test and Cold Pressor Test.

**Results**: There is an increase in basal heart rate and Systolic BP among RA patients which was statistically significant. The rise in Diastolic BP during the sympathetic function tests were found to be significantly lower among RA patients ($P< 0.001$).Hence sympathetic autonomic dysfunction is present among RA patients. This dysfunction showed no correlation to age, gender, disease duration and RF positivity.

**Conclusion:** Autonomic sympathetic dysfunction occurs in RA patients. Early diagnosis and intervention of Autonomic dysfunction among RA patients may help in improving their quality of life and assist in their treatment.

**Key words:** Sympathetic nervous system,Cold Pressor Test, Hand Grip Dynamometer test.

## Introduction

Rheumatoid Arthritis (RA) is a chronic inflammatory disorder affecting primarily the peripheral joints[1]. This disorder not only affects the joints but also many systems like the Respiratory, Cardiovascular and the Nervous system particularly autonomic nervous system involvement has been commonly encountered among RA patients[2]. This autonomic dysfunction results due to the effect of disease process on the Sympathetic and Parasympathetic nerve fibres[3]. This dysfunction has great impact on the cardiovascular system. It manifests as cold peripheral extremities, syncope attacks, orthostatic hypotension and sexual dysfunction. It greatly affects the quality of life of RA patients and in some patients increases the risk of Arrhythmias, Myocardial Infarction and sudden cardiac death.[4] Hence this study was conducted to assess the cardiovascular Sympathetic function among RA patients.Two non-invasive tests were used namely the Sustained Hand GripTest andCold PressorTest .Early diagnosis and intervention of autonomic dysfunction among RA patients may help



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in improving their quality of life and assist in their treatment.

**Aims and objectives**

The study was conducted to assess the cardiovascular sympathetic function among RA patients. This study also analyzed the correlation of sympathetic function with age, gender, disease duration and RF factor positivity.

**Materials and Methods**

This cross sectional study was conducted among 200 RA patients aged 22-55 years attending Rheumatology clinics in a tertiary care hospital. This study was approved by the institutional ethical committee.Age matched control group included 100 healthy persons. The RA patients were diagnosed based on ACR criteria. Patients with other chronic illness like Diabetes, Hypertension, history of chronic drug intake, anemia (Hemoglobin below 10g/dl) and pregnancy were excluded from the study.

**Test procedure**

The study details were clearly explained to the subjects and informed consent was obtained. A complete clinical examination was done before doing the test. Resting pulse rate and basal Blood Pressure were recorded. Sympathetic system was assessed using the Sustained Handgrip Test and Cold Pressor Test.

**Sustained Hand Grip test**

The maximum voluntary contraction was first determined using Handgrip Dynamometer. The participant was then asked to maintain the handgrip at 30% of that maximum for 5 min. The Blood Pressure was measured 3 times before and at one min interval during the Handgrip test. The result was expressed as difference between highest diastolic BP during handgrip and mean of three diastolic BP. The result was considered normal if rise in diastolic BP was 15mmHg or more.[5-6]

**Cold Pressor Test**

For theCold Pressor Test the subjects were asked to immerse their hand into cold water ($3^0$-$4^0$C) for 3 min. BP was recorded every 30,60 and 120 seconds and also after taking the hand out of the cold water bath. The result was considered normal if the diastolic BP rise was above 15mmHg and if below it was considered abnormal.[5, 7]

**STATISTICAL ANALYSIS**

Student unpaired t Test was used for analysis. Correlation of effects of age,gender, seropositivity and disease duration on sympathetic function was done using Spearman and Pearson's R Correlation test.

**Results**

In this study 200 Rheumatoid Arthritis patients were enrolled. The mean age of the study population was 43.50 $\pm$8.33years. Among them 60% were female patients. The mean duration of the disease at the time of study was 3.45$\pm$ 2.37. Rheumatoid Factor positivity was present among 69.86% of the cases. The mean ESR value was found to be around 45mm/hr. The age and sex matched control group included 100 persons. The demographic data of case and control group is depicted in the table -1



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**Table1 Demographic profile of study population**

| Profile | | Groups | | P Value |
|---|---|---|---|---|
| | | Cases n =200 | Controls n =100 | |
| Age in Years | <40(n) | 80(40%) | 35(35%) | 0.42 |
| | >40(n) | 120(60%) | 65(65%) | |
| Sex | Male (n) | 55(27.5%) | 25(25%) | 0.34 |
| | Female(n) | 145(72.5%) | 75(75%) | |

The basal heart rate, systolic and diastolic BP were recorded among the case and control group. It was found that there was a significant increase in basal heart rate and systolic BP among RA patients. Basal diastolic BP showed no such significant increase among RA patients.

The basal heart rate and Blood Pressure values are given in table- 2

**Table 2Basal heart rate and Blood Pressure values**

| Variables | Groups | | | | P Value |
|---|---|---|---|---|---|
| | Cases n =200 | | Controls n=100 | | |
| | Mean | SD | Mean | SD | |
| Basal heart rate | 82.38 | 8.74 | 71.54 | 2.34 | 0.000* |
| Basal systolic BP | 112.56 | 15.68 | 111.43 | 15.75 | 0.047* |
| Basal diastolic BP | 74.62 | 7.04 | 75.74 | 5.68 | 0.906 |

*Significant SD Standard Deviation

Cardiovascular Sympathetic function was assessed and compared among case and control group using two tests namely the Sustained Handgrip test and Cold Pressor test. The values of diastolic BP recorded during the test procedure in different groups are depicted in table 3



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**Table- 3;Rise in diastolic BP during the sympathetic tests**

| Sympathetic function test | Groups | | | | | | | | P Value |
|---|---|---|---|---|---|---|---|---|---|
| | Cases n =200 | | | | Control n=100 | | | | |
| | Female | Male | <40yrs | >40yrs | Female | Male | <40yrs | >40yrs | |
| Hand grip test | 7.15 ±8.20 | 3.67 ±9.98 | 7.32 ±6.76 | 7.35 ±7.61 | 17.62 ±5.73 | 18.32 ±5.13 | 18.13 ±5.65 | 17.56 ±5.14 | 0.000* |
| Cold Pressor test | 7.78 ±8.79 | 8.69 ±8.17 | 7.44 ±7.92 | 7.63 ±7.81 | 18.09 ±5.96 | 18.65 ±5.72 | 18.76 ±4.73 | 18.34 ±4.86 | 0.000* |

*Significant

There was a less marked rise in diastolic BP during Sustained Handgrip test among the Rheumatoid patients which was statistically Significant (P<0.001). Similarly the rise in diastolic BP during Cold Pressor test was also found to be significantly lower among RA patients (P< 0.001). The significant difference in diastolic BP during the tests between case and control groups had no sex or age difference. This shows that sympathetic autonomic dysfunction is significantly present among RA patients. This sympathetic dysfunction showed no correlation to age, gender, disease duration and RF positivity.

**Discussion**

This study was doneto assess the sympathetic function among RA patients using two non-invasivetests. In this study the basal heart rate was found to be significantly elevated in RA patients(82.38 Vs 71.54 BPM, P<0.001) This observationwas similar to that of Leden et al[8] and to our previous study[9]done to assess the cardiovascular parasympathetic function . The increased basal heart rate may be due to the damage of peripheral vagal fibers as occurring in chronic diseases like Diabetes.[10]The same pathophysiology may occur in chronic inflammatory disease such as Rheumatoid Arthritis also. Similarly the basal systolic BP was also found to be high among the cases.

The significant change in BP was observed in 13.12% of our RA patients which is similar to various studies.[11-12]In our study the diastolic rise in BP was significantly less during Handgrip and Cold Pressor tests. The reduced rise in DBP in Handgrip test is similar to the study done by Sandhu et al.[13]Ferdousi et al[14] have said that such reduced rise in DBP may be due to less marked peripheral sympathetic reactivity among RA patients. This is in contrary to Louthreno et al[15] who have demonstrated a greater rise in DBP in response to sustained handgrip. As in Handgrip test there was a less marked rise in diastolic BP during Cold Pressor test. This is similar to the study of Bidikar et al.[2] Many studies have demonstrated similar autonomic dysfunction among RA patients.[14-16] The abnormal sympathetic test in our patients was only weakly associated to gender and there was no correlation to age ,duration of disease and RF status. This is in contrast to Castro et al[17]and Sandhu et al[12]observation were the dysfunction worsened as the duration of disease increased.The possible pathogenesis factor involved in altered ANS function in RA patients include primary disturbance of ANS

present in preclinical phase or a secondary response to inflammatory process or may be due to the action of auto antibodies against cervical ganglia, Nerve Growth Factor and Vagus nerve.[18]

**Conclusion**

Cardiovascular sympathetic reflex responses were reduced in RA patients. Autonomic sympathetic dysfunction occurs in RA patients. A detailed study to find out other factors associated with sympathetic dysfunction and the effect of sympathomimetic drugs on RA patients will aid in improving their quality of life.

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