₹ 200 ISSN - 2249-555X
Volume : 1 Issue : 11 Aug 2012

Indian Journal Of Applied Research

Journal for All Subjects

www.ijar.in

Listed in International ISSN Directory, Paris.

ISSN - 2249-555X

Indian Journal of Applied Research

Journal for All Subjects

Editor,
Indian Journal Of Applied Research
8-A, Banans, Opp. SLU Girls College, New Congres Bhavan, Paldi,
Ahmedabad-380006, Gujarat, INDIA
Contact.: +91-9824097643 E-mail : editor@ijar.in

INDEX

Volume : 1 | Issue : 11 | August 2012 ISSN - 2249-555X

Research Paper MEDICAL SCIENCE

Rate Pressure Product In Type 2 Diabetic Cardiac Autonomic Neuropathy

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ABSTRACT

Cardiac autonomic neuropathy is linked to unexplained sudden and silent death in type 2 diabetics. Altered cardiovascular haemodynamics or blood flow may be substantially involved in adverse cardiovascular mortality. Case control study was done on age matched (40-60years) type 2 diabetics (n=100) with and without cardiac autonomic neuropathy divided into two groups of 50 each. Rate pressure product, non invasive indicator of myocardial blood flow, was calculated and results analysed using one way ANOVA (SPSS software). A significantly heightened rate pressure product was observed in cardiac autonomic neuropathy patients compared to non neuropathy counterparts (p<0.1). Resting rate pressure product was found to be highest (>12) in neuropathy patients.

Our findings suggest that type 2 diabetic cardiac autonomic neuropathy significantly increases resting rate pressure product. This reflects heightened resting myocardial blood flow. It leaves little capacity of the body to increase blood flow further especially at times of need contributing to exaggerated ischemic episodes.

Keywords : Diabetic cardiac autonomic neuropathy, Myocardial blood flow, Rate pressure product

Introduction:-

Autonomic Nervous System plays an important role in regulation of myocardial function, heart rate & myocardial blood flow. Chronic imbalance of autonomic nervous system is prevalent & potent risk factor for adverse cardiovascular events including mortality.1 Within ten years of developing overt symptoms of autonomic neuropathy, 30-50% of the patients are dead, many from sudden cardio respiratory arrest – the cause of which is unknown.2 The exact mechanisms remain unclear. An insight into the state of myocardial blood flow in diabetic cardiac autonomic neuropathy patients can help clear doubts surrounding this mystery. Rate Pressure Product or the Double product is the product of heart rate and systolic blood pressure. It is a major determinant of cardiac oxygen consumption and hence a predictor of myocardial blood flow.3 We aimed to assess the status of myocardial blood flow in diabetic cardiac autonomic neuropathy patients using a non invasive parameter - Rate Pressure Product.

Material and Methods:-

Study was carried out on 100 subjects taken from a tertiary health care hospital in Northern India. This study was approved by the Institutional Review Board of our hospital in accordance with Helsinki Declaration of 1964. Informed written consent was taken from each subject before commencing the test. Fasting / Random blood sugar test was performed using glucometer. Blood pressure was recorded using sphygmomanometer and heart rate calculated from lead II from ECG recording (cardiofax, Medicaid Systems). The subjects were divided into two groups of 50 each. Group A: 50 subjects of either sex between age group of 40-60 years having type 2 diabetes with cardiac autonomic neuropathy. These patients were having a postural fall in BP > 30 mm Hg and impaired hand grip.4 Group B: 50 subjects of either sex between age group of 40-60 years having type 2 diabetes without cardiac autonomic neuropathy. These patients did not show a postural fall in BP. Detailed history was taken from all the subjects and recorded on a special proforma. Exclusion Criteria: Subjects were examined to rule out Ischaemic Heart Disease, Congestive heart failure and Cardiac arrhythmias.

Rate Pressure Product Calculation

It is a product of systolic blood pressure and heart rate.5

RPP = Systolic Pressure in mm Hg x Heart Rate in beats/ min x 10-2

The value obtained is expressed as mm Hg. beats per min.10-2 Values were expressed as mean + Standard Deviation and stastical analysis done using one way ANOVA with SPSS software. Probability value of P<0.1 was taken as level of significance.

Result:- See Table 1 and Figure 1 before references.

As highlighted in table 1, stastical analysis using one way ANOVA, demonstrated that type 2 diabetics with cardiac autonomic neuropathy had a significantly higher resting rate pressure product than type 2 diabetics without cardiac autonomic neuropathy (P<0.1). Fig. 1 shows that the mean resting rate pressure product was highest in type 2 diabetics with cardiac autonomic neuropathy (>12).

Discussion:-

In our study, the resting RPP was found to be significantly higher in type 2 diabetic cardiac autonomic neuropathy patients.(P<0.1). Previous studies have shown that diabetes has an independent association with heightened rate pressure product.6 But our study confirmed the association of double product with diabetic cardiac autonomic neuropathy also. This may be because of relatively increased sympathetic tone present in diabetics with cardiac autonomic neuropathy. Since parasympathetic fibres are affected earlier there is a relative increase in sympathetic tone. Sympathetic fibres get damaged at least five years after parasympathetic fibres causing postural hypotension.7 Heightened double product at rest suggests that these patients have higher myocardial oxygen consumption at rest. Some investigators have observed that angina pectoris occurs at a constant value of Rate Pressure Product and that the degree of ST segment depression is correlated with Rate Pressure Product. Thus the risk of cardiovascular problems increases with greater levels of Rate Pressure Product.8 Another observation in this study was that the resting rate pressure product was highest in diabetics with cardiac autonomic neuropathy as shown by figure 1. The mean normative value of Rate Pressure Product as calculated by manufacturers of RPP unit, Pepper MG & Crawley BE is < 12 (where heart rate is between 60-120 beats per minute and systolic blood pressure between 100-140 mm Hg

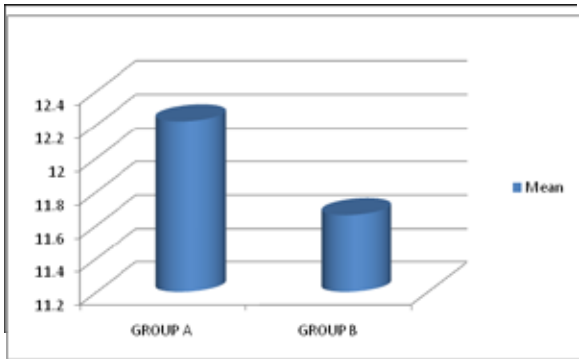
and RPP = HR X SYSP/1000).9 It was found to be >12 in cardiac autonomic neuropathy group. The group without cardiac autonomic neuropathy had the values within this normative range but other group fell out of it. Justin R concluded in his study that subjects with coronary artery disease with blood glucose levels > 110mg/dL have significantly higher rate pressure product at rest. Since already rate pressure product at rest is high so there is little capacity of the body to increase it further and improve myocardial perfusion.10 This renders diabetic autonomic neuropathy patients vulnerable to various cardiac risks like left ventricular dysfunction, cardiac arrhythmias, silent myocardial infarction, cardiac arrest and sudden death on exposure to current life stress episodes. We conclude that rate pressure product is significantly higher in type 2 diabetic cardiac autonomic neuropathy. We have found that type 2 diabetics who have cardiac autonomic neuropathy have resting rate pressure product values > 12. It is out of the mean normative range suggesting a higher, almost fixed myocardial oxygen demand, resulting in little capacity of body to improve it further, potentially contributing to sudden adverse cardiovascular events.

Table 1:- Rate Pressure Product in type 2 diabetics with and without cardiac autonomic neuropathy

Groups	Age(Mean ± SD)	RPP(Mean ± SD)	F - ratio	P – value
Group A (with neuropathy)	53.65 ± 8.00	12.22 ± 1.82	2.788	0.098*
Group B (without neuropathy)	52.05 ± 5.70	11.66 ± 1.67		

*P<0.1 significant

Fig. 1:- Resting Rate Pressure Product in type 2 diabetics with and without cardiac autonomic neuropathy



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