

IS AUTONOMIC DYSFUNCTION INTRICATELY ASSOCIATED WITH SOMATOFORM DISORDERS? AN ANALYTICAL STUDY IN KOLKATA

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ABSTRACT

BACKGROUND

Somatoform disorder is nowadays considered as the most frequent psychiatric diagnosis in general practice and is diagnosed in 16.1% of consecutive consulting patients. Physiological disturbances are so common in somatization that it can easily maintain the body focus, and symptom misinterpretations of a person having somatoform dysfunction. The interaction between 'psyche' and "soma" happens through a complex network of feed-back and modulation among the central and autonomic nervous system. We wanted to assess the status of autonomic function as per existing standard (Ewing's) test protocol among study population and evaluate the association between autonomic functions and somatoform disorders.

METHODS

A cross-sectional, analytical study was conducted using five non-invasive tests as per existing Ewing's test protocol among fifty newly diagnosed somatoform disorder patients of 18-40 years age group of both sexes who had been attending psychiatry out-patient department along with age and sex matched healthy subjects.

RESULTS

There was significant difference in 30:15 ($p= 0.02$), VR ($p= 0.04$) responses between cases & control groups indicating reduced parasympathetic activity and comparing study subjects with control subjects no significant difference in blood pressure response to standing. IHG test response was found to exist indicating no change in sympathetic activity among somatoform disorder patients compared to control subjects.

CONCLUSIONS

Reduced parasympathetic activity and no sympathetic dysregulation were present among patients of somatoform disorders and this should be taken care of as reduced parasympathetic activity might cause cardiovascular disturbances.

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BACKGROUND

Somatoform disorder (SD) is the presentation of functional complaints as organic or physical. Here anxiety arises when physical sensations are misinterpreted as evidence of organic pathology and physiological symptoms associated with anxiety again fuel the body focused attention.¹ Somatoform disorder is nowadays considered as the most frequent psychiatric diagnosis in general practice and is diagnosed in 16.1% of consecutive consulting patients.² The interaction between 'psyche' and "soma" are well known. This interaction happens through a complex network of feed-back and modulation among the central and autonomic nervous system, the endocrine system, immune system and the stress system.³

Physiological disturbances are so common in somatization that it can easily maintain the body focus and symptom misinterpretations of a person having somatoform dysfunction.⁴

A recent model by Brown (2004) addresses on this issue by showing how physical symptoms can arise and the autonomic control of action is over-determined by typical presentation of illness.⁵

Disorders of autonomic nervous system play a crucial role in the pathogenesis and clinical course of many diseases. Many methods evaluating the autonomic nervous system have been described. The availability of non-invasive techniques like monitoring subtle changes in heart rate and blood pressure are now replacing earlier painful techniques. The heart rate and blood pressure can be mapped during rest as well as to certain provocative manoeuvres. Given the complexity of the autonomic nervous system there is no single test that precisely reflects function of a specific branch of this system.

As such there is no definite study to determine whether the persons misinterpreting their normal bodily sensations, do really have any physiological difference in autonomic functions. Some tests to assess autonomic function had been chosen as per existing Ewing's test protocol⁶. These tests were performed among newly diagnosed somatoform disorder patients of 18- 40 years age group of both sexes who had been attending psychiatry OPD along with age and sex matched healthy subjects.

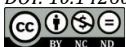
With this background, the present study was conducted among newly diagnosed patients of somatoform disorders and their age and sex matched controls in a government teaching hospital in Kolkata with the following Objectives:

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1. To assess the status of autonomic function as per existing standard (Ewing's) test protocol among study population.
2. To find out the association between autonomic functions and somatoform disorders.

METHODS

Study Type, Design and Population

A cross-sectional, analytical study was conducted during March 2015- February 2016 at Department of Physiology and Psychiatry out-patient department (OPD) of the teaching hospital. Study group comprised of all the patients attending Psychiatry OPD of the hospital for the first time and diagnosed as Somatoform disorders as per diagnostic guidelines of ICD 10⁷ during the study period. Their age and sex matched accompanying person without any psychiatric morbidity were selected as a control group. The ratio of study and control group was 1:1.

Sample Size and Sampling Design

In this study consecutive sampling method was used. The Out-patient Department (OPD) day was selected randomly per week. On that particular day during the study period all newly diagnosed cases of somatoform disorder within 18 - 40 years age group were recruited from.

For selection of controls, among the companion of the patients age and sex match similar number of subjects were selected randomly and recruited after screening using GHQ-28⁸.

Exclusion Criteria

Individuals having cardiac disease, hypertension, diabetes mellitus, neurological disease, retinopathy, nephropathy, autoimmune diseases, any other acute or chronic systemic disease(s) or associated factor(s) that may affect the autonomic reflexes were not included in the study or control group.

Methods of Data Collection

Clinical history was taken from each individual and general examination was performed by the competent Psychiatrists. Autonomic function tests were performed using standard battery of tests in laboratory setting according to the protocol of Ewing and Clarke⁶. Pre-test instructions were given to avoid consumption of any medications that may alter the autonomic function 48 hours prior to the test. No study subjects were allowed to consume cigarette, nicotine, coffee, food or medicines from two hours prior to the test.⁶ The subjects were asked to wear loose gowns, and to remove tight under clothing, metallic objects like rings, watches etc.

The subjects were asked to take rest for 15 minutes in supine position just before the commencement of the tests. The resting time after each test was 5 to 10 minutes.⁶ The tests were performed in an equable environment with room temperature ranging from 18°-28° C. A basal recording of the resting heart rate (RHR) by using Polyrite-D, and blood pressure for screening and drawing a baseline was taken first, followed by the autonomic function tests. The following test parameters were assessed in the specific sequence as given below.

Autonomic Function Tests for Parasympathetic Activity

1. Heart rate response to postural change (30:15).
2. Heart rate variation during Deep breathing (HRDB) or Deep Breath Difference (DBD).
3. Heart rate response to Valsalva manoeuvre (Valsalva Ratio or VR).

Autonomic Function Tests for Sympathetic Activity

1. Blood pressure response to standing (Orthostatic test).
2. Blood pressure response to sustained isometric hand-grip (IHG).

Study Tools and Techniques

- A. Case Record sheet
- B. General Health Questionnaire-28
- C. Polyrite D (Recorder and Medicare Systems Pvt. Ltd.)

(A) Tests for Autonomic Function⁶

Heart Rate Response to Postural Change (30:15)

After a complete rest of 15 minutes in supine position the ECG recording was started, and the subject assumed erect posture from the supine position as quickly as possible (within 3 seconds) with continuous ECG recording for 30 seconds or more in erect posture. The ratio of the longest RR interval around 30th beat after standing to the shortest RR interval around 15th beat after standing was calculated for result of 30:15.

Heart Rate Variation During Deep Breathing (HRDB) or Deep Breath Difference (DBD)

The patient was instructed to take deep inspiration over 5 secs and followed by expiration over next 5 secs completing one respiratory cycle and six cycles were repeated. The difference of the heart rate between the maximum in the inspiratory cycle (I) and the minimum in the expiratory cycles (E) was calculated and used as the result.

Heart Rate Response to Valsalva Manoeuvre

A mercurial sphygmomanometer was improvised by modifying with a mouthpiece and a body tube of a 10 ml disposable hypodermic syringe in place of the air pump, and connected directly to the tube leading to mercury bulb⁶. A small leak in the mouth piece was allowed.⁹

The subject was instructed to exhale forcefully through the mouth piece of the modified mercurial sphygmomanometer and to maintain pressure in the manometer up to 40 mmHg for 15 seconds. ECG recording was taken during the manoeuvre and continued for about 30 seconds after the performance. Nasal clip was used to stop nasal breathing of the subject during this manoeuvre. The ratio of the longest RR interval after blowing to the shortest RR interval during blowing was calculated. The highest ratio of the three manoeuvres was used as the result of Valsalva ratio (VR).

Blood Pressure Response to Standing (Orthostatic Test)

Resting blood pressure was recorded. Then the patient was asked to stand up and the blood pressure was recorded immediately ('0' minute). The difference between the systolic blood pressure (SBP) while lying down and the SBP while the subject stood, was calculated. The fall in systolic blood pressure was used as the result of orthostatic test.

Blood Pressure Response to Sustained Isometric Hand-Grip (IHG)

In sitting position, the subject was asked to press the hand grip dynamometer at 30% of maximum voluntary contraction for two minutes. Blood pressure was measured before and after contraction at two minutes in contralateral arm. Difference in resting diastolic blood pressure (DBP) before hand-grip and highest DBP during hand-grip was noted.

Statistical Analysis

All the collected data were at first entered a Microsoft Excel spreadsheet and were checked for consistency. Percentage mean (\pm standard deviation) of the data was calculated. After that association between variables was tested with Pearson’s chi-square test and Fischer’s exact test where Cochran criteria was not fulfilled.

Tests	Parameters	Normal	Borderline	Abnormal
Heart Rate Response to Standing	30: 15	≥ 1.04	1.01 - 1.03	≤ 1.00
Heart Rate Response to Deep Breathing	Maximum Minus Minimum Heart Rate (E-I)	≥ 15	11 - 14	≤ 10
Heart Rate Response to Valsalva Manoeuvre	Valsalva Ratio (VR)	≥ 1.21	1.11-1.20	≤ 1.10
Blood Pressure Response to Standing	Fall in SBP (mmHg)	≤ 10	11- 29	≥ 30
Blood Pressure Response to IHG	Rise in DBP (mmHg)	≥ 16	11- 15	≤ 10

Normative Values of Cardiovascular Autonomic Function⁶

Ethical Consideration

The study was commenced after receiving clearance from Institutional Ethics Committee. Written informed consent was obtained from each study subject.

Additional Resources

Not applicable.

RESULTS

The current study is an analytical observational study among fifty subjects who have been newly diagnosed as case of somatoform disorder by psychiatrists of the hospital and fifty age and sex matched healthy adults to assess and compare the cardiovascular autonomic functions. Over the study period, a total number of sixty-one newly diagnosed somatoform disorder patients had been referred from Psychiatry OPD, who gave informed consent to participate in the study. Due to presence of one or more co-morbidities or inability to perform the tests, 11 study subjects were excluded from the study in the beginning. The final size of study group was fifty. Equal number of age & sex matched persons fulfilling the selection criteria were included in the control group.

Among the case 80% were female and among control 66% were female. As per the test result there was no significant difference (Pearson Chi square test: Value = 2.468, $p = 0.113$) between case and controls regarding gender. According to table 1; significant difference was present in 30:15 ($p = 0.02$), VR ($p = 0.04$) responses between somatoform disorder patients & control groups and there was no significant difference in heart rate variation to deep breathing, blood pressure response to standing or IHG test response of case and control groups.

Table 2 showed that there is significant difference in mean score of 30:15 ($p = 0.003$), VR ($p = 0.01$) of parasympathetic function and no significant difference in sympathetic test results between cases & control groups.

Study Variables of Autonomic Function	Variable Categories	Cases (%)	Control (%)	χ^2 / Fisher’s Exact Test (p value)
30:15	Abnormal	2(4.0)	0	5.26 (0.02)
	Borderline	3 (6.0)	0 (0.0)	
	Normal	45 (90.0)	50 (100.0)	
DBD	Abnormal	1 (2.0)	0 (0.0)	1.00* (0.317)
	Normal	49 (98.0)	50(100.0)	
VR	Borderline	4(10.0)	0 (0.0)	4.125* (0.042)
	Normal	46(92.0)	50 (100.0)	
Blood Pressure Response to Standing	Normal	37(74.0)	30 (60.0)	1.654 (0.198)
	Borderline	13 (26.0)	20 (40.0)	
IHG Test	Normal	25(50)	30 (60.0)	1.295 (0.52)
	Borderline	13 (26.0)	12 (24.0)	
	Abnormal	12 (24.0)	8 (16.0)	

Table 1. Comparison of Different Categories of Study Variables of Autonomic Functions Between Cases & Control Groups

* Fisher’s Exact Test is done

Study Variables of Autonomic Function	Cases	Controls	Independent-Sample t Test (p Value)
	Score (Mean \pm SD)	Score (Mean \pm SD)	
30:15	1.19 \pm 0.15	1.28 \pm 0.11	-3.045 (0.003)
DBD -	32.10 \pm 18.84	35.72 \pm 11.38	-1.163 (0.248)
VR	1.66 \pm 0.31	1.84 \pm 0.39	-2.523 (0.013)
Orthostatic Test - Fall in SBP (mmHg)	8.96 \pm 5.42	10.28 \pm 5.51	-1.207 (0.23)
IHG Test- Rise in DBP (mmHg)	15.36 \pm 8.27	16.56 \pm 8.31	-0.724 (0.471)

Table 2. Comparison of Mean Score of Various Study Variables of Autonomic Functions Between Cases and Control Groups

DISCUSSION

To the best of our knowledge there is very limited information regarding cardiovascular autonomic function test outcome in somatoform disorder patients. Possibly this is the first study where autonomic function tests using Ewing’s protocol has been applied among somatoform disorder patients.

In this study the somatoform disorder patients showed reduced parasympathetic activity which may be explained by Porge’s Polyvagal theory. According to this theory the vagus

nerve has a modulating or regulating role and connects to various brain regions and serves as a brake or modulator. Conditions of extreme stress break down this highly sensitive means for stabilizing the human organism. This thereby causes decreased parasympathetic activity in somatoform disorder patients¹⁰.

The study subjects consisted of different age groups ranging from 18 – 40 years with the mean age 29.04 ± 6.8 years. Different studies like that of Deveci A. et al in Turkey (2007), showed the peak incidence in the mid to late thirties¹¹. This may be due to the fact that the symptom onset of somatoform disorder usually occurs in the adolescence or before and at least some of the symptoms must be developed before the age of thirty¹². No significant difference ($p > 0.05$) was found between case and control groups regarding age and sex distribution in present study. Therefore, it can be concluded that case and control groups were age and sex matched.

The autonomic nervous system includes a neural mechanism in which most of its functions are carried out involuntarily. Both parasympathetic and sympathetic nervous system control heart rate, blood pressure and maintain the balance. Resting heart rate can be used to assess both SNS and PNS reactivity¹³. In the present study, mean resting heart rate was higher in somatoform disorder patients (85.98 ± 10.69) than control subjects (72.54 ± 7.15). Compared to control a significant difference ($p = 0.006$) of resting heart rate was also found among somatoform disorder patients. This difference in resting heart rate between somatoform disorder patients and control group was clinically significant. This may be explained by reduced parasympathetic activity. A study by Filiz I. et al in 2015 showed that mean heart rate was 86 ± 13 beats per minute among conversion disorder patients which is a sub variant of somatoform disorder^{14,15}. In the present study resting systolic and diastolic blood pressure was in the normal range in both case and control groups and no significant difference were also seen among case and control subjects. This may presumably because of multiple blood pressure regulatory systems running in parallel and autonomic disturbances might have been counterbalanced by other regulatory mechanisms.

In the present study majority of subjects (90%) with somatoform disorder had normal heart rate response (30: 15) to postural change and 6% and 4% had borderline and abnormal responses respectively and also there was a significant difference ($p = 0.02$) in 30: 15 score in case and control subjects. The mean score of 30:15 response between somatoform disorder patients and healthy adults had significant difference ($p = 0.003$). In case of heart rate response to Valsalva manoeuvre (VR) 92% of somatoform disorder patients had normal Valsalva ratio and significant difference ($p = 0.01$) of mean score of VR was found between somatoform disorder patient and control group. Both the results indicate reduced parasympathetic activity in somatoform disorder patients. In a different study, Viehof Z. et al (2016) found reduced heart rate variability among somatoform disorder patients¹⁶. Heart rate variability means beat to beat variation in length of time and it is a measure of parasympathetic activity. Reduced heart rate variability means para-sympathetic disturbances. Majority of patients (98%) showed normal heart rate response to deep breathing

and while comparing the mean score of DBD of somatoform disorder patients with control subjects no significant difference ($p = 0.25$) was found. In the present study 74% of study subjects showed normal blood pressure response to standing and 26% had borderline response. In control subjects also 60% showed normal and 40% had borderline response. In the present study 50% of somatoform disorder patients had normal response to isometric hand grip test (IHG) whereas 26% and 24% had borderline and abnormal result respectively. Comparing study subjects with control subjects no significant difference for mean score of blood pressure response to standing or IHG test response was found to exist indicating no change in sympathetic activity among somatoform disorder patients compared to control subjects.

So, from this study finding it is evident that sympathetic dysregulation may not have any role in the pathogenesis of somatoform disorders though these patients had reduced parasympathetic activity. Reduced parasympathetic activity indicates low vagal tone or autonomic rigidity which may lead to many cardiovascular disturbances.

CONCLUSIONS

Somatoform disorder patients had reduced parasympathetic activity which was significantly different from control subjects. However, no significant difference was present in sympathetic activity between somatoform disorder subjects and control population. According to ICD-10, individual who presents with repeated physical symptoms, together with persistent requests for medical investigations, in spite of repeated negative findings and reassurances by doctors that these symptoms have no physical basis, are categorized as somatoform disorders.¹⁷ However this does not mean that these symptoms are without physiological correlates. Although there may not be any evidence of discrete organic pathology, demonstrable physiological changes can still increase the risk of development and maintenance of physical complaints.¹⁸ In the most general sense, there is empirical evidence of a link between somatoform disorders and altered functioning of central nervous system which has gradually replaced suggested abnormalities in specific organ system.¹⁹ These study findings serve to remind us that somatoform disorders are not to be regarded as "all in mind."²⁰ This disease should get more attention from treatment perspectives as this lowered parasympathetic activity may result in catastrophic health problem. As the sample size was small, further study is needed with larger sample size.

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