Original Research Article

Prevalence of ECG abnormalities in chronic spinal cord injury patients with deranged lipid profile

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ABSTRACT

Background: Spinal cord injury (SCI) is a catastrophic, unfortunate event which results in profound disability and secondary complications like neurogenic shock, arrhythmias, autonomic dysfunction, pressure ulcers, etc. These patients are at increased risk for the cardiovascular risk factors (like obesity, dyslipidemia and diabetes) and cardiovascular complications due to hampered mobility and impaired autonomic system. Therefore, these patients with must be screened quite frequently for cardiovascular problems.
Methods: The study was an analytic cross-sectional study, to assess the prevalence of ECG abnormalities and deranged lipid profiles in the spinal cord injury patients and to access the correlation between these two in chronic Spinal Cord Injury patients. The early morning fasting blood samples were collected for the lipid profile test and thrice daily resting 12 lead ECG were done for all the patients for a month and were analyzed in context with their previous available ECGs from their respective records.
Results: A total of 52 SCI patients were taken up for the study, of them 30 was paraplegic and 22 were tertraplegic. Out of 52, lipid profiles were deranged in 31 patients of which 17 had normal ECG and lipid profile was normal in 21, of which only 1 patient had an ECG abnormality. It was found that that out of 52 patients cholesterol levels were deranged in 17 patients, LDL in 6, triglycerides in 15 patients and the values of HDL were normal in all.
Conclusions: The most common abnormality found in this population of SCI patients was sinus bradycardia. There was only one ECG which showed T-wave abnormalities suggesting possible myocardial ischemia.

Keywords: Chronic spinal cord injury patients, Deranged lipid profile, ECG abnormalities

INTRODUCTION

Spinal cord injury (SCI) is a catastrophic, unfortunate and terminal event that impairs motor, sensory, and autonomic functions of a person for life-time.[1-7] Spinal cord injury results in profound disability and these patients have various secondary complication attributable to SCI like neurogenic shock, arrhythmias, autonomic dysfunction, pressure ulcers, bowel and bladder dysfunctions, chronic pain, anxiety, recurrent urinary tract infections.[8-15] These patients have an increased risk for the cardiovascular complications due to hampered mobility and impaired autonomic system.[16,17] Most of the time, much attention is paid to the acute complications and their management, underestimating the chronic cardiovascular complications, which are the leading cause of mortality and morbidity in the spinal cord injury patients.[16-18] ECG is a convenient, precise and very effective tool diagnose or to detect these problems at an early stage. Abnormal ECG finding are common acutely after the spinal cord injury due to arrhythmias or spinal

dysautonimias.[19,20] But ECG abnormalities in chronic SCI patient are still not well studied.[21]

Previous studies have shown that difference in ECG abnormalities of SCI patients can be attributed to the level of injury, age of the patient, or degree of sympathetic impairment.[22-24] Complications related to the cardiovascular system are very high in spinal cord injury patients due to a relatively sedentary post injury lifestyle with higher susceptibility and prevalence of other cardiovascular risk factors like obesity, dyslipidemia and diabetes.[25] Therefore, the patients with the spinal cord injury must be screened quite frequently compared to normal individuals for cardiovascular problems. This study was designed to test the potential benefit of screening for electrocardiographic abnormalities in individuals with chronic SCI who have multiple risk factors for CVD, particularly abnormal lipid profiles.

METHODS

The study was an analytic cross-sectional study, to assess the prevalence of ECG abnormalities and deranged lipid profiles in the spinal cord injury patients and to access the correlation between these two in chronic Spinal Cord Injury patients.

Inclusion criteria

- All spinal cord injury patients who gave consent for the study were included in the study.

Exclusion criteria

- Patients having any previously known cardiac co-morbidity or disease prior to the spinal cord injury.

The Study was conducted on 52 spinal cord injury patients. The study was carried out in one of the premier tertiary care hospital in India. The hospital has an attached Spinal Cord Injury Centre (SCIC) and Paraplegic Rehabilitation Centre (PRC) which treats spinal cord injury patients and also helps them in post injury rehabilitation. The SCIC and the PRC also have an attached physiotherapy centre where the patient can exercise to their maximum physical activity limits on the daily basis in the presence of the physiotherapy experts. Along with physiotherapy there are various other physical activities and sports which are planned and organized for these patients. These centers are a part of the hospital complex so the patients are in the approach of the hospital facilities whenever they require and there weekly and monthly health assessment is also done at the hospital. The consent was taken from the patients and the hospital authorities prior to the study.

Data collection and analysis

The early morning blood samples with at least 14 hours of fasting were collected of all the patients for the lipid profile test. All the prerequisite precautions for the lipid profile test were strictly adhered to before collecting the blood samples.

ECG findings

Thrice daily resting 12 lead ECG were done for all the patients for a month and were analyzed in context with their previous available ECGs from their respective records. This was to rule out any incidental finding in their ECG and to reconfirm the present findings.

RESULTS

A total number 52 SCI patient were taken up for the study, of them 30 was paraplegic and 22 were tertraplegic. A 14 hour fasting blood samples were collected to carry out the lipid profiles of the patients, strictly adhering to the precautions and prerequisites for the test. In lipid profile, total cholesterol, high density lipoprotein, low density lipoprotein and triglyceride levels were assessed. The ECG abnormalities were not diagnosed on the basis of any single ECG reading but thrice weekly ECGs were taken at three different times in supine position after rest of atleast 10 minutes for at least 1 month and were compared with at least 2 previous ECG's done 3 months apart. Out of 52, lipid profiles were deranged in 31 patients of which 17 had normal ECG and lipid profile was normal in 21, of which only 1 patient had an ECG abnormality. It was found that that out of 52 patients cholesterol levels were deranged in 17 patients, LDL in 6, triglycerides in 15 patients and the values of HDL were normal in all.

Table 1: Lipid profile results of the spinal cord injury (SCI) patients.

	CH	LDL	HDL	TG
Deranged	17	6	0	15
Normal	35	46	52	37
Total	52	52	52	52

Table 2: The number of parameters deranged in the lipid profile of the spinal cord injury (SCI) patients versus number of patients.

Number of parameters deranged	Number of patients
None of the parameters was deranged	10
Only one profile deranged	8
Only two profiles deranged	10
Three profiles deranged	6
All profiles deranged	0

In none of the patients all the four parameters were deranged, 3 out of the four parameters were deranged in 6 patients, two were deranged in 10 and only one parameter of the profile was deranged in 10 patients.

Amongst the paraplegic patients (30), 4 patients had an ECG abnormality, out of which 2 had a partial RBBB and 1 had a partial RBBB with sinus tachycardia and 1 had sinus bradycardia. Rest 26 had no ECG abnormality. Amongst the tetraplegic (22) patients, 11 patients had an ECG abnormality, out of which 5 had sinus bradycardia, 2 had a partial RBBB, 1 had a partial RBBB WITH sinus bradycardia, 1 had left axis deviation, 1 had left ventricular hypertrophy and 1 had Q wave inversions in leads (V1-V4). Rest 11 had no ECG abnormality.

Table 3: Various ECG abnormalities found in the spinal cord injury (SCI) patients.

ECG abnormalities found in the sci patients	No. of patients with these ECG abnormalities
Paraplegics	30
Partial RBBB	2
Partial RBBB with sinus tachycardia	1
Sinus bradycardia	1
No abnormality detected	26
Tetraplegics	22
Sinus bradycardia	5
Partial RBBB	2
Partial RBBB with sinus bradycardia	1
Q Wave inversion (V1-V4)	1
Left ventricular hypertrophy	1
Left axis deviation	1
No abnormality detected	11
Grand total	52

The data shows there were 31 patients who had deranged lipid profiles out which 17 showed normal ECG while out of remaining 21 normal lipid profiles only 1 had deranged ECG.

During the regression analysis, the regression equation is: $Y = 04594 - 0.1927X$

- The p value (probability of committing a type 1 error) corresponding to the above t stat is 6.9487782397775. Hence, there is no probability of the two variables being unrelated
- The standard error of the regression coefficient is 0.08, which is small. This means that the value of the coefficient is precise (lower the standard error, higher the accuracy)
- Overall, the model is a reasonably not a good representation of the true relation between lipid profile and ECG findings.

DISCUSSION

As the population in the study was attached to a rehabilitation centre with all types of rehabilitative facilities and resources available, these patients are well managed and guided by the physiotherapists so as to avoid immobility and to perform exercises to the best possible extent. Along with this, they are made to follow a strict exercise and diet schedule. They are also helped using tilt table and wheel chair ambulation aided with daily chest and calf physiotherapy. Following a strict regimen, proper exercise and a diligent diet could be the reasons for different results in this study.

Sinus bradycardia was the most common abnormality with very less prevalence of T wave abnormalities in this population. This is juxtaposed with the study done by Blocker et al, which showed a greater prevalence of T-wave abnormalities in SCI patients, while another study by Prakash et al showed similar prevalence of ECG abnormalities in individuals with SCI as compared to those without SCI, and also, no prognostic implications of ECG abnormalities.[25,26] In this study there were no definitive signs of myocardial ischemia or any abnormality indicative of coronary artery disease. Singer and Levinson found in their study that T-wave abnormalities and overall morbidity was highest in SCI patients who were in 40- to 49-year age group. This study also suggests that the risk of adverse outcomes also increases twice in these patients.[25-27] All the ecgs in this study were taken in supine position so as to avoid the potential influence of the body position on the ECG.[28-30]

Some of the ECG abnormalities like sinus bradycardia can be attributed to the level of the spinal cord injury and associated autonomic impairment but rest of the abnormalities cannot be totally explained by the spinal cord injury and by autonomic impairment as none of the study participants had a recent injury or were not in the state of dysautonomia at the time of taking ECG. Standard precautions were followed while taking ECGs of all the patients, a series of ECGs were considered to confirm the abnormality. Inspite of the abnormalities due to the autonomic impairment and the level of injury rest there is not much difference in the prevalence of the other ECG abnormalities in these patients compared to the normal patient population. Due to the spinal cord injury these patients have immobility, dysautonomia and metabolic impairments as additional risk factors.

But interestingly, chronic SCI patients especially those with longer duration of injury are at a higher risk of developing a CVD compared to the others. These individuals should therefore be carefully monitored for the presence of silent ischemia, and physicians caring for individuals with chronic SCI should include ECG in their routine screening procedures. While age is an important determinant of risk for CVD in persons without disability, for individuals with chronic SCI and with risk factors for CVD, injury duration is at least as important. Individuals with SCI are now living longer and thus, similar to the population of individuals without disabilities, will have increased incidence of CVD.

ECG abnormalities in patients with SCI were not very indicative of ischemic changes. Some of the abnormalities may be attributed to the level of the injury and autonomic dysfunction. ECG abnormalities are not very different from normal population, suggesting that the ECG has similar value as a screening tool in the two populations.

CONCLUSION

The most common abnormality found in this population of SCI patients was sinus bradycardia. There was only one ECG which showed T-wave abnormalities suggesting possible myocardial ischemia.

In a nutshell, the prevalence of ECG findings in patients with SCI provides support for the ECG as part of routine/annual clinical evaluation in patients with SCI, coupled with assessment of concurrent cardiac disease. Evaluation of follow-up ECGs and prospective evaluation of cardiac mortality, currently underway, is expected to strengthen the evidence for prognostic interpretation of ECG findings in this population.

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