International Journal of Psychiatry Research
www.psychiatryjournal.in
Online ISSN: 2664-8970, Print ISSN: 2664-8962
Received: 20-02-2022, Accepted: 06-03-2022, Published: 21-03-2022
Volume 4, Issue 1, 2022, Page No. 1-5

"Mind over heart": Mental stress and ischemic heart disease-potential implications during covid-19

Vikas Dhikav
Niirncd, Jodhpur, Rajasthan, India

Abstract
It has long been believed that mental stress predisposes towards ischemic heart diseases (IHD) or may worsen it. Several studies have now shown that increase in sympathetic over-activity, platelet activation, liberation of pro-inflammatory cytokines, over-activation of hypothalamic pituitary adrenal axis and overproduction of pro-coagulant factors contribute to increase in the risk of mental stress induced IHD. Stress hormones released during stress may cause heart to beat faster and pump harder leading to ischemia, arrhythmias and sometimes heart attack. Looking after cardiac health is all the more important during this crucial period of COVID-19 pandemic as the amount of stress world faces could be multifold.
Considering the evidence in support of connection between mental stress and heart disease; Specially in the ongoing situation, there are reasons to believe in the philosophy of 'mind over heart matters'. In susceptible individuals, either due to genetic vulnerability ('hypersensitive heart') or hyper-responsive adrenergic system or deficient stress coping mechanisms or a combination of these three; there is an adverse cardiac response to emotions. This could produce silent or florid ischemia. Resulting damage could be subtle or substantial. Now with challenging times of COVID-19 around with high probability of mental stresses; the effect of the same on heart could be significant.
Hence, there appears a need to address the role of mental stress in provoking IHD during COVID-19 times. There seems to be a need to offer help to individuals who are at risk of 'emotional turmoil induced cardiac damage' (Takotsubo cardiomyopathy or broken heart syndrome) and address their mental stress to reduce adverse effects on their cardiovascular health. Yoga, timely counseling, psychosocial support, especially during COVID-19 times could be useful in mitigating the adverse impact of COVID-19 induced mental stress on heart disease.

Keywords: mental stress, ischemic heart disease

Introduction

People often associate stress with something that is 'distressing' and 'uncomfortable'. Enough evidence is available that links the relationship between ischemic heart disease (IHD) and psychological, psychosocial, and emotional stress[1-16]. Historically, the association between mental stress and heard disease goes to Ancient times of Aristotle who asserted that heart was the seat of emotions (Figure-1). Such a description could also be found on Ancient Hindu Scriptures and *Vedic* philosphy. Hippocratic and Galenic Medicine have put a great emphasis on interactions between emotions, behavior and physiology.
Though there are various definition of what constitutes stress are available. A medical dictionary defines stress as a condition that impinges upon an individual from the outside world. Most of the general public defines stress as a "physical, mental, or emotional strain or tension". Apart from day-today affairs; a variety of neurological (e.g. Alzheimer's disease) and psychiatric disorder (e.g. depression, anxiety) can also generate significant stress. Most people consider the definition of stress to be something that causes distress. However, stress is not always harmful since increased stress results in increased productivity up to certain level (stress performance curve is bell shaped). 'Flight or fight response' of Canon is well known to medical people. Hens Seyle emphasized the role of adrenal glands in stress about 50 years ago [17-18].
Stress induced cardiomyopathy, also called as Takotsubo cardiomyopathy or broken heart syndrome is characterized by sudden onset of chest pain and cardiac dysfunction that mimics heart attack. In patients with preexisting diagnosis of generalized anxiety disorders or others who are anxiety prone, the increased possibility of such a disease cannot be overemphasized specially during COVID-19 pandemic.
Scientists have long puzzled over the fact that many heart attacks occur in patients with no obvious coronary risk factors e.g. obesity, hyper-lipidemia, hypertension etc. Over the last 30 years; some researchers have steadfastly believed that the way individuals behave, think, feel or conduct can have profound effect on the heart ('mind heart connection'). It is important to underline that a relationship between mind and heart [19-35]. Has long been (Figure-1).

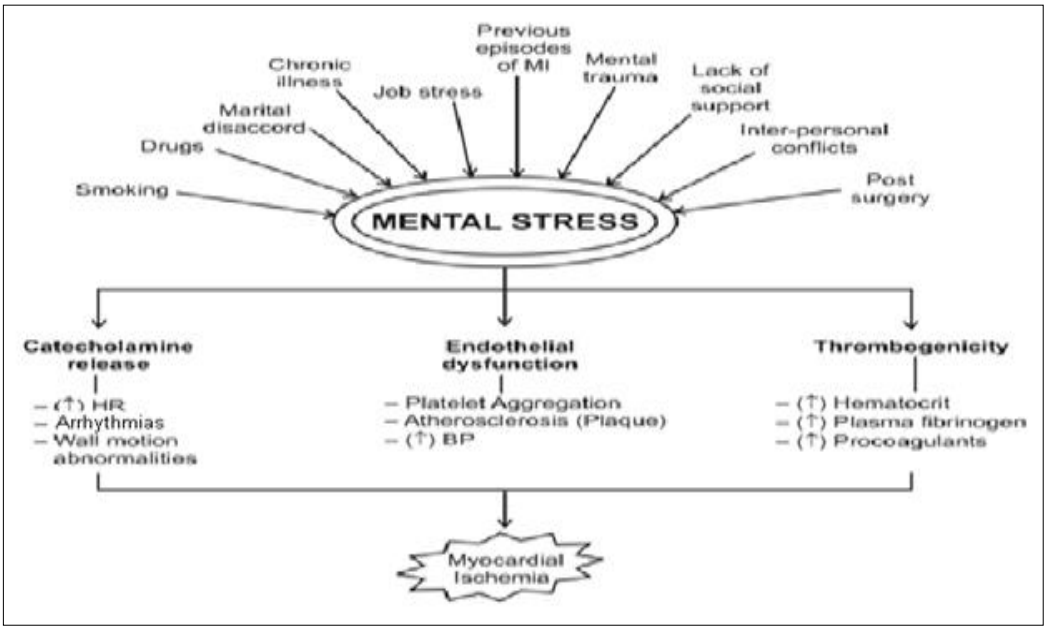

Fig 1: Interrelationship between various factors leading to mental stress and ischemic heart disease (Figure-courtesy AITBS publishers & distributors, India).

'Mind over Heart'-hypothesis

It is believed that some individuals are more likely to have emotional stress induced myocardial damage (Figure-3).

a. These may have abnormal beta-adrenergic receptors ('hypersensitive heart') in the heart and/or may have hyper-adrenergic drives.
b. Some may have abnormal mental conditioning to stress due to adverse environments leading to defective coping mechanisms and are therefore at high risk of myocardial damage provoked by stress.
c. Others may have a combination of all of these factors operating.

These patients may have disproportionate cardiac responses to emotional stress leading to myocardial damage. This could create a spectrum of myocardial damage (Figure-2).

Hypersensitive heart, hyper-responsive sympathetic drive and defective coping mechanisms coupled with emotional stress could produce potentially hazardous environment for myocardium. Polymorphism of beta-adrenergic receptors could have potential therapeutic relevance[36-40]. There is evidence available that beta-adrenergic receptor polymorphism is associated with mental stress induced myocardial ischemia[41]. This appears relevant during challenging times of COVID-19 pandemic.

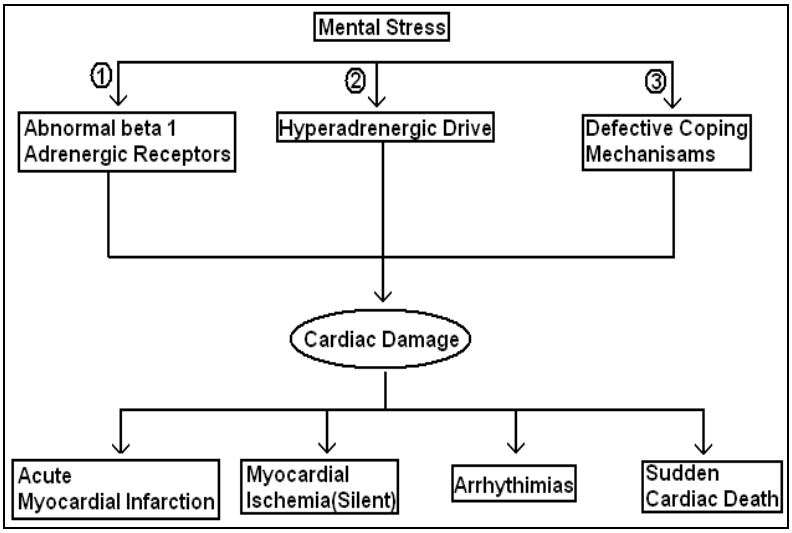

Fig 2: 'Mind over heart-hypothesis. Individuals who are prone to the development of mental stress induced myocardial silent ischemia or frank damage may have mutated beta-1 adrenergic receptors in heart and/or may also have hyper-responsive sympathetic system. This coupled with mental conditioning due to environmental influences could lead to a cocktail of abnormal heart, hyperactive sympathetic system and deficient stress coping mechanisms. Resultant effect could lead to myocardial damage. Myocardial damage could result from any loop (1, 2 & 3).

Testing the present hypothesis

Testing the present hypothesis would involve a combination of investigations:

a. Genotyping of beta-1 adrenergic receptors could be done for knowing if their hearts contain mutated beta-1 adrenergic receptors ('hypersensitive heart'). Then the density of beta-adrenergic receptors in individuals prone to mental stress induced myocardial damage could be measured and compared with the controls.
b. Stress Coping Assessment can be done using available Stress Measurement Inventories and an attempt could be done to identify 'coronary prone' individuals.
c. Biochemically, stress measurements could be done using estimation of catecholamine metabolites in both plasma and urine and measuring stress hormones such as cortisol or norepinephrine.
d. Using myocardial perfusion scan, the effect of mental stress in 'predisposed individuals' identified with their clinical histories (e.g. angina gets precipitated by emotional upset) could be quantified.
e. A scoring system of 'cardiac proneness' assigned based upon certain criteria could be formulated. This could be consisting of the following:

1. An individual who may have poor Stress Coping Skills.
2. Abnormal beta-1adrenergic receptors in the heart.
3. High adrenergic drive.

An individual may have either: (i), (ii), (iii) or all three. Naturally, those with all factors will be at highest risk of mental stress induced myocardial damage. Since there are several confounding factors associated with myocardial ischemia or damage; one would need to look into and balance them during hypothesis testing. That means, any factor that could increase adrenergic drive could potentially lead to the same consequences as emotional stress. If confounders are not adequately balanced; this could be an important drawback of hypothesis.

Potential Implications of the Present Hypothesis

Identifying the relationship between heart and mind could have important diagnostic, prognostic and therapeutic implications. Basic and clinical studies have identified the relationship between adrenergic receptor polymorphism and hemodynamic and myocardial responses to ischemic stress[36]. This may suggest that specific genetic variability related to these receptors may be linked to excessive physiological responses to adrenergic stimulation. Once we identify the abnormal beta-adrenergic receptors or individuals with high adrenergic drive or stress poor coping skills; perhaps we could identify people who are risk of mental stress induced adverse outcomes.

Indian approches of handling Emotional Stress

Establishing the 'mind-heart' connections is one aspect; but preventing mental stress induced adverse outcome is another. Evidence indicates that this is possible presently. Indian approaches to combat stress have been in vogue since time immemorial. Out of the eastern approaches, *yoga* is perhaps the best studied method. *Yoga* consists of specific form of exercises which harmonizes energy. Chakras are centers of energy in body. *Yoga* has been advised for improvement of well-being [42-43]. It has also been shown to improve metabolic parameters in patients with metabolic syndrome[44] reduce symptoms of stress in survivors of tsunami survivors [45] and reduce symptoms of depression and anxiety in women [46]. A systematic analysis of *Yoga* may have promise for the prevention and management of cardiovascular complications [47-48]. Similarly, it has been proposed that meditation has stress reliving effect [49-50] in the same way, mind body fitness has been proposed to be useful in preventing hypertension that is a potential risk factor for IHD [51]. Several studies suggest that religious involvement or spiritual well-being may affect health outcomes. It has been seen that degree of spiritual well-being may be an important factor in the development of IHD [52-53].

Ischemic heart disease during Covid-19

Since pressures on the healthcare facilities during COVID-19 times is overwhelming, it can be unnerving to get the chest pain and have the feeling that doctors might not be available to treat the same. Prevention of IHD during this time is more relevant than ever before. Research has suggested that older people with cardiovascular diseases are prone to severe COVID-19 [54]. Also, infection is associated with multiple direct and indirect cardiovascular complications like myocardial infarcation, myocarditis, arrhythmias and thromboembolism[55]. Prevalence of mental health related issues with cardiovascular diseases are 3 folds higher compared to general population[56]. Additionally, a wide range of issues[56] like unemployment, bereavement, grief, mental stress due to illnesses, sleep related and relationship issues could complicate the already precarious cardiovascular fitness in certain individuals. Stress induced cardiomyopathy is likely during these times [57].

Conclusions

'Mind body connection' is increasingly getting appreciated; especially with regard to IHD and is more relevant during these challenging times of COVID-19 [58] than ever before. Enough evidence seems to have accumulated to assume that mental stress has an important role in precipitating or aggravating IHD. 'Hyper-sensitive heart' in association with high adrenergic drive and coupled with poor stress handling can create a situation conducive to adverse outcome related to mental stress. With increase in urbanization, competitiveness and combativeness; the role of emotional and mental factors might increase in the times to come. Therefore, it becomes important to

control these factors, wherever possible. Eastern approaches to stress reduction include yoga [59-60] and meditations etc. have been shown to be effective in controlling stress.

References

1. Hornstein C. Stress, anxiety and cardiovascular disease: an interdisciplinary approach. Vertex,2004:15(1):21-31.
2. Rees K, Bennett P, West R, Davey SG, Ebrahim S. Psychological interventions for coronary heart disease. Cochrane Database Syst Rev,2004:2:CD002902
3. Strike PC, Steptoe A. Systematic review of mental stress-induced myocardial ischaemia. Eur Heart J,2003:24(8):690-703.
4. Belialov FI. Psychosomatic aspects of ischemic heart disease. Kardiologiia,2002:42(8):63-7.
5. Denollet J. Type D personality. A potential risk factor refined. J Psychosom Res,2000:49(4):255-66.
6. Krantz DS, Sheps DS, Carney RM, Natelson BH. Effects of mental stress in patients with coronary artery disease: evidence and clinical implications. JAMA,2000:283(14):1800-2.
7. Tennant C. Life stress, social support and coronary heart disease. Aust N Z J Psychiatry,1999:33(5):636-41.
8. Währborg P. Mental stress and ischaemic heart disease: an underestimated connection. Eur Heart J,1998:19(1):O20-3.
9. Pandya D. Psychological stress, emotional behavior & coronary heart disease. Compr Ther,1998:24(5):265-71.
10. Alonzo AA, Reynolds NR. The structure of emotions during acute myocardial infarction: a model of coping. Soc Sci Med,1998:46(9):1099-110.
11. Verrier RL, Mittelman MA. Cardiovascular consequences of anger and other stress states. Baillieres Clin Neurol,1997:6(2):245-59.
12. Mohan R. Psychological factors in ischemic heart disease. Indian J Public Health,1996:40(4):134-8.
13. Greenwood DC, Muir KR, Packham CJ, Madeley RJ. Coronary heart disease: a review of the role of psychosocial stress and social support. J Public Health Med,1996:18(2):221-31.
14. Brezinka V, Kittel F. Psychosocial factors of coronary heart disease in women: a review. Soc Sci Med,1996:42(10):1351-65.
15. Williams RB, Littman AB. Psychosocial factors: role in cardiac risk and treatment strategies. Cardiol Clin,1996:14(1):97-104.
16. Grippo AJ, Johnson AK. Stress, depression and cardiovascular dysregulation: a review of neurobiological mechanisms and the integration of research from preclinical disease models. Stress,2009:12(1):1-21.
17. Selye H. The Significance of The Adrenals For Adaptation. Science,1937:85(2201):247-248.
18. Selye H, Horava A. Stress Research. Science,1953:117(3045):509.
19. Grippo AJ, Johnson AK. Stress, depression and cardiovascular dysregulation: a review of neurobiological mechanisms and the integration of research from preclinical disease models. Stress,2009:12(1):1-21.
20. Grippo AJ. Mechanisms underlying altered mood and cardiovascular dysfunction: the value of neurobiological and behavioral research with animal models. Neurosci Biobehav Rev,2009:33(2):171-80. Epub 2008 Jul 29.
21. Rozanski A, Blumenthal JA, Kaplan J. Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. Circulation,1999:99(16):2192-217.
22. Jiang W. Impacts of depression and emotional distress on cardiac disease. Cleve Clin J Med,2008:75(2):S20-5.
23. Roose SP, Miyazaki M. Pharmacologic treatment of depression in patients with heart disease. Psychosom Med,2005:67:S54-7.
24. Roose SP. Considerations for the use of antidepressants in patients with cardiovascular disease. Am Heart J,2000:140(4):84-8.
25. Nalivaiko E, Sgoifo A. Central 5-HT receptors in cardiovascular control during stress. Neurosci Biobehav Rev,2009:33(2):95-106. Epub 2008 Jun 5.
26. Jørgensen HS. Studies on the neuroendocrine role of serotonin. Dan Med Bull,2007:54(4):266-88.
27. Hill M, Weber R, Werner S. The heart-mind connection. Behav Healthc,2006:26(9):30-2.
28. Pickering T, Clemow L, Davidson K, Gerin W. Behavioral cardiology --has its time finally arrived? Mt Sinai J Med,2003:70(2):101-12.
29. Graves KD, Miller PM. Behavioral medicine in the prevention and treatment of cardiovascular disease. Behav Modif,2003:27(1):3-25.
30. Haskell WL. Cardiovascular disease prevention and lifestyle interventions: effectiveness and efficacy. J Cardiovasc Nurs,2003:18(4):245-55.
31. Daviglus ML, Lloyd-Jones DM, Pirzada A. Preventing cardiovascular disease in the 21st century: therapeutic and preventive implications of current evidence. Am J Cardiovasc Drugs,2006;6(2):87-101.
32. Brisson C et al. Job Strain and Risk of Acute Recurrent Coronary Heart Disease Events. The Journal of American Medical Association,2007:298:14:1652-1660
33. Orth-Gomér K et al. “Marital Stress Worsens Prognosis in Women With Coronary Heart Disease” The Stockholm Female Coronary Risk Study. The Journal of American Medical Association,2000:284:23:3008-3014

34. Erikson W. "The Role of Social Support in the Pathogenesis of Coronary Heart Disease." A Literature Review. Family Practice, Oxford Journals,1994:2:201-209
35. Lett HS. Social Support and Coronary Heart Disease: Epidemiologic Evidence and Implications for Treatment. Psychosomatic Medicine, Journal of Biobehavioral Medicine,2005:67:869-878.
36. Kirstein SL, Insel PA. Autonomic nervous system pharmacogenomics: a progress report. Pharmacol Rev,2004:56(1):31-52.
37. Flordellis C, Paris H, Karabinis A, Lymperopoulos A. Pharmacogenomics of adrenoceptors. Pharmacogenomics,2004:5(7):803-17.
38. Schaak S, Mialet-Perez J, Flordellis C, Paris H. Genetic variation of human adrenergic receptors: from molecular and functional properties to clinical and pharmacogenetic implications. Curr Top Med Chem,2007:7(2):217-31.
39. Brodde OE, Bruck H, Leineweber K. Cardiac adrenoceptors: physiological and pathophysiological relevance. J Pharmacol Sci,2006:100(5):323-37. Epub 2006 Apr 13.
40. Brodde OE. Beta1- and beta2-adrenoceptor polymorphisms and cardiovascular diseases. Fundam Clin Pharmacol,2008:22(2):107-25.
41. Hassan M, York KM, Li H, Li Q, Gong Y, Langaee TY, et al. Association of beta1-adrenergic receptor genetic polymorphism with mental stress-induced myocardial ischemia in patients with coronary artery disease. Arch Intern Med,2008:168(7):763-70.
42. Greenwood DC. et al. Coronary heart disease: a review of the role of psychosocial stress and social support. Journal of Public Health Medicine, Oxford University Press,1996:18:2:221-231.
43. Sharma R, Gupta N, Bijlani RL. Effect of *yoga* based lifestyle intervention on subjective well-being. Indian J Physiol Pharmacol,2008:52(2):123-31.
44. Cohen BE, Chang AA, Grady D, Kanaya AM. Restorative *yoga*in adults with metabolic syndrome: a randomized, controlled pilot trial. Metab Syndr Relat Disord,2008:6(3):223-9.
45. Oken BS, Zajdel D, Kishiyama S, Flegal K, Dehen C, Haas M, et al. Randomized, controlled, six-month trial of *yoga*in healthy seniors: effects on cognition and quality of life. Altern Ther Health Med,2006:12(1):40-7.
46. Telles S, Naveen KV, Dash M. *Yoga*reduces symptoms of distress in tsunami survivors in the andaman islands. Evid Based Complement Alternat Med,2007:4(4):503-9.
47. Javnbakht M, Hejazi Kenari R, Ghasemi M. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of *yoga*on depression and anxiety of women. Complement Ther Clin Pract,2009:15(2):102-4.
48. Innes KE, Vincent HK.The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. : Evid Based Complement Alternat Med,2007:4(4):469-86.
49. Ziegelstein RC. Acute emotional stress and cardiac arrhythmias. JAMA,2007:298(3):324-9.
50. Rubia K. The Neurobiology of Meditation and its clinical effectiveness in psychiatric disorders. Biol Psychol, 2009, 22. [Epub ahead of print].
51. King MS, Carr T, D'Cruz C. Transcendental meditation, hypertension and heart disease. Aust Fam Physician,2002:31(2):164-8.
52. La Forge R. Mind-body fitness: encouraging prospects for primary and secondary prevention: J Cardiovasc Nurs,1997:11(3):53-65.
53. Morris EL. The relationship of spirituality to coronary heart disease. Altern Ther Health Med,2001:7(5):96-8.
54. A Novel COVID-19 & its effects on heart. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7191131/ (Accessed online on August 1st 2020).
55. Cardiovascular considerations for patients, health care workers and health systems during the COVID-19 pandemic. https://www.sciencedirect.com/science/article/pii/S0735109720346374 (Accessed online on August 1st 2020).
56. Are individuals with cardiovascular disease at risk of COVID-19 related at risk of COVID-19 related mental health problems or individuals with cardiovascular diseases at risk of cardiovascular disease-related mental health problems during COVID-19? A psychological-psychiatric perspective. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7261099/(Accessed online on August 1st 2020).
57. Incidence of stress cardiomyopathy during the coronavirus disease 2019 pandemic. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2768093 (Accessed online on August 1st 2020).
58. Moady G, Atar S. Quarantine-induced Stress Cardiomyopathy (Takotsubo syndrome) during the COVID-19 pandemic. Isr Med Assoc J,2021:23(3):149-152. PMID: 33734626.
59. Dhikav V, Karmarkar G, Gupta R, Verma M, Gupta R, Gupta S, Anand KS. Yoga in female sexual functions. J Sex Med,2010:7(2 Pt 2):964-70. Doi: 10.1111/j.1743-6109.2009.01580.x. Epub 2009 Nov 12. PMID: 19912493.
60. Dhikav V, Karmarkar G, Gupta M, Anand KS. Yoga in premature ejaculation: a comparative trial with fluoxetine. J Sex Med,2007:4(6):1726-32. Doi: 10.1111/j.1743-6109.2007.00603.x. Epub 2007 Sep 21. PMID: 17888067.