



RISK OF HRIDROGA (CARDIOVASCULAR DISORDER) IN AMAVATA PATIENTS (RHEUMATOID ARTHRITIS) AMONG COASTAL POPULATION: A HEALTHCARE CHALLENGE

Ravi Golghate¹. Gouri Mulik². Suhas Mohite³

¹Ph.D Scholar, Rognidan & Vikriti Vigyan, LRP Ayurvedic Medical College, Islampur, Sangli, Maharashtra, India. (HOD, Bhaisaheb Sawant Ayurved, College, Sawantwadi, Sindhudurg, Maharashtra, India)

²Guide, Professor & HOD, Rognidan & Vikriti Vigyan, LRP Ayurvedic, Medical College, Islampur, Sangli, Maharashtra, India.

³Associate Professor, Panchakarma, LRP Ayurvedic Medical College, Islampur, Sangli, Maharashtra, India.

Corresponding Author: golghateravi3@gmail.com

<https://doi.org/10.46607/iamj0411122023>

(Published Online: December 2023)

Open Access

© International Ayurvedic Medical Journal, India 2023

Article Received: 13/11/2023 - Peer Reviewed: 30/11/2023 - Accepted for Publication: 13/12/2023.



ABSTRACT

Amavata (RA), which is a systemic disease affecting mainly Koshta (gastrointestinal tract) and Sandhi (marmasandhigat vyadhi), is a prevalent condition encountered in our day-to-day practice. In modern science, Amavata can be correlated with Rheumatoid Arthritis. The association between RA and heart disease has been studied extensively, and the results are concerning. Patients with RA have an average risk of heart disease that is almost 50 percent higher than the general population. Changes in the occurrence/ outcome of Amavata due to Geographical differences must be considered. According to our observation, Amavata prevalence in the coastal population was exceptionally higher than in any other region. Inadequate access to healthcare services and limited health knowledge in remote coastal locations are associated with a higher burden of such chronic diseases. This Review article focuses on the need to understand and assess the risk of Hridroga (CVD) in Amavata vyadhi (RA) among the Coastal population so that we can help them lower the incidences of this vyadhi and its Updravas (complications).

Keywords: Amavata, Rheumatoid Arthritis, cardiovascular diseases, coastal population.

INTRODUCTION

The eternity of Ayurveda is in the sense of its great affection in its approach to diseases, people, and life. There are many non-communicable diseases in which Amavata (Rheumatoid Arthritis) and Hridroga (cardiovascular diseases) are tremendously increasing in our society due to changes in diet patterns, lifestyle, and environmental conditions. They are also known as chronic diseases. Although many advanced techniques exist to cure such diseases and live life further, these techniques are not pocket-friendly to every human being. Amavata (RA), which is a systemic disease affecting mainly Koshta (gastrointestinal tract) and Sandhi (marmasthisandhigat vyadhi), is a prevalent condition encountered in our day-to-day practice. Hridgraha (stiffness in the cardiac region) is one of the symptoms mentioned in the Pravridhha Amavata (advanced stage of this disease)¹. Hridgraha (stiffness in the cardiac area) is one of the symptoms of Hridroga. The Nidanpachaka of Hridroga vyadhi (CVD) has been explained in Ayurved Samhitas. In modern science, Amavata can be correlated with Rheumatoid Arthritis. The association between RA and heart disease has been studied extensively, and the results are concerning. Patients with RA have an average risk of heart disease that is almost 50 percent higher than the general population^{2,3}. The morbidity rate of Amavata patients due to cardiovascular events is high among them. Variations in the occurrence/ outcome of Amavata due to Geographical differences must be considered. According to our observation, Amavata prevalence in the coastal population was exceptionally higher than in any other region. Furthermore, inadequate access to healthcare services and limited health knowledge in remote coastal locations are associated with a higher burden of chronic diseases (e.g., Arthritis, cardiovascular and hypertension).⁴ Ayurveda focuses more on prevention of disease rather than a curative aspect.⁵ Despite innovative advances made in the management of patients with RA, premature mortality from comorbid diseases remains a significant challenge. This Review article focuses

on the need to understand and assess the risk of Hridroga (CVD) in Amavata vyadhi (RA) among the Coastal population so that we should help them to lower the incidences of this vyadhi and its Updravas (complications). By understanding Amavata vyadhi in the coastal area population, we can help them reduce the incidences of this vyadhi and its updrava, especially Hridroga. This study will give broad spectrum data on the Amavata vyadhi and actual knowledge of its role as an updrava in the manifestation of Hridroga (cardiovascular pathological conditions). Identifying those Amavata patients with high risk of cardiovascular disorders and providing them with appropriate treatment can prevent premature deaths among the coastal population.

Material and methods:

- A review has been done of Ayurvedic texts, modern science literature, various research publications, government projects, internet resources, etc.
- Research studies from Google Scholar, Medline/PubMed, Scopus, etc. databases have been reviewed to analyze data regarding the topic.

Review of Amavata and Hridroga vyadhi from Ayurvedic perspective:

- Amavata, a systemic disease affecting mainly Koshta and Sandhi (marmasthisandhigat vyadhi), is a prevalent condition encountered in today's practice. Amavata is a disease with two predominant factors: ama and vata. Agni plays an essential role in the manifestation of the disease. When a person having Mandagni follows wrong food habits, it results in the production of Ama. Ama and vitiated Vata move all over the body and get Sthanasanshraya (accumulation) at the Sleshma sthanas like Sandhis (Joints). Amavata is Kapha Vata dominant Tridoshaja Vyadhi. Rasa, Mamsa. Asthi Majja are involved in the pathogenesis. The strotodushti of Annavaha, Rasavaha, Asthivaha, and Majjavaha are present. Vyakti Sthana is Sarvashareera, particularly Sandhi sthan (Joints). It

mainly affects Sandhies and produces symptoms like aruchi, gaurava, angamardana, alasya, Jwara, Sandhi shoola, Sandhi Shotha which are the cardinal symptoms of Amavata⁶.

- Hridgraha (stiffness in the cardiac region) is one of the symptoms mentioned in the Pravridha Amavata. Hridgraha (stiffness in the cardiac region) is one of the symptoms of Hridroga. The Nidanpachaka of Hridroga vyadhi has been explained in Ayurved Samhitas⁷. Depending upon the severity, Madhavkara classified the disease Amavata into two categories:-1. Samanya Amavat and 2. Pravridha Amavata. In Samanya Amavata the symptoms are less severe, but in Pravridha Amavata, the symptoms are more severe, and they present with Upadrava. In Madhava Nidana, the following etiological factors are mentioned which are responsible for causing the Amavata⁸:- Viruddha Ahara (Unbalanced diet), Viruddha Chesta (Improper physical activity), Mandagni (weak digestive power), Nishachalata (lack of physical exercise), Snighdham Bhuktavato vyayamam (Exercise immediately after Snigdha Ahara).
- In the disease pathogenesis, if samprapti ghataka are more powerful and the patient continues with the causative factors, he may develop Updravas (complications). The involvement of complications turns the disease towards kashtasadhyatva^{9,10}.

Review over Rheumatoid Arthritis :

- Rheumatoid arthritis (RA) is a chronic, multisystem, inflammatory, autoimmune, arthritis of peripheral joints usually with symmetrical distribution having unknown cause which, if left untreated, leads to functional disability, pain, reduced health-related quality of life and premature mortality. It is estimated to affect between 0.5 - 1.0% of the adult population worldwide, increases in prevalence with age and affects more women than men with a prevalence of 460 per 100,000 people. On a global scale, RA affects about 3 people in every 10,000 and has a prevalence rate of about 1 percent (which increases with age and is highest between 35 and 50 years of age)^{11,12,13}.
- The magnitude of the severe long-term economic consequences of RA has been underestimated in the past. Most patients with the disease require continuous treatment to retard or stop progression and to control disease flares. Many also require surgery, such as total hip or knee replacement. In addition to these direct costs, work disability leads to reduced productivity and early retirement, and as a result, substantial indirect costs. The individual and his or her family must cope with the feeling of loss of contribution to society combined with redefined social roles, and the effects of pain, fatigue, low self-esteem, mental distress and depression. Disease severity, activity and disability are strongly linked to premature mortality in patients with RA¹⁴.

Epidemiology of the risk of hridroga (CVD) in Amavata (RA) patients:- extend of the burden:

- Several epidemiological studies in the last few decades confirmed that patients with RA are 30 to 60% more likely to suffer Cardiovascular events than subjects from the general population^{15,16}.
- In a retrospective study of a baseline cohort of RA patients in Rochester, MN, we found that RA patients had an increased risk of cardiovascular disease, coronary heart disease, and heart failure compared with age- and sex-matched community controls. In addition, when we examined coronary tissue from necropsied RA patients. We observed an increase in inflammation and an increased proportion of unstable plaques. Epidemiological studies have shown that patients with RA are more likely to have silent coronary heart disease, heart failure, and sudden death compared with controls.¹⁷.
- In a recent study, RA patients have a four-fold increase in CV risk compared to the general population from the same geographic location. However, no mortality studies of CV events among Indian RA patients are available. Since the 1960s, the gap in CVD mortality between RA patients

and the general populations in other countries has widened, as RA patients have remained at an increased risk compared with general populations¹⁸. A standardized mortality ratio derived from a meta-analysis of North American and European studies suggests that mortality from CV events is 1.5-fold higher among RA patients than among the general population^{19,20}. Most epidemiological work suggests that cardiovascular mortality is increased in RA, with standardized mortality ratios of between 1.13 and 5.15^{21,22,23,24}.

- Many observational trials have shown that higher disease activity leads to increased cardiovascular risk, e.g., in a Dutch study, the researchers found that an increased DAS-28 score of 1 unit resulted in a 28% increased CV risk, irrespective of the disease duration. Vice versa, one can expect a reduced CVD risk with lower disease activity. In a large-scale trial done in 2015, Solomon et al. showed that a 10-point reduction in the CDAI (Clinical disease activity index) resulted in a 26% reduction in CV events^{25,26}.

Possible Pathogenesis of CVD in RA patients:

- Cardiovascular disease (CVD) is well recognized as the most common cause of mortality in patients with RA, being associated with endothelial dysfunction and arterial stiffness due to inflammation-associated loss of elasticity of the vascular wall. This results from alterations in the structural proteins, collagen, and elastin, leading to accelerated atherosclerosis, usually detected by measuring carotid intima-media thickness^{27,28,29,30}.
- Chronic, low-grade systemic inflammation leading to prolonged endothelial activation and an accompanying pro-thrombotic/ pro-coagulant state is believed to be the major contributor to the increased risk of CVD in RA³¹. Some of the most prominent proposed immunopathogenic processes underpinning these events are summarized as follows: increased systemic levels, presumably synovium-derived, of the endothelial-activating cytokines interleukin (IL)-1 β , IL-6, tumor necrosis factor (TNF)- α and interferon (IFN)- γ ^{32,33}

binding and activation of neutrophils, monocytes, and platelets to cytokine-activated, pro-adhesive vascular endothelium, potentiated by the neutrophil and monocyte chemokines, CXCL8 (IL-8) and CCL2, respectively.³³ Systemic activation of platelets, not only via interaction with cytokine-sensitized vascular endothelium and proximal neutrophils/monocytes, which may trigger further platelet activation via protease-activated receptors (PARs) 1 and 4, but also by exposure to AC-PA³⁴, activation of vascular endothelium PAR-1 by adherent neutrophils/monocytes, thereby exacerbating systemic inflammation and endothelial dysfunction,³⁵ creation of a pro-inflammatory milieu conducive to the formation of pro-atherogenic oxidized low-density lipoprotein³⁶ NETs, in turn, contribute to the intravascular, pro-inflammatory/ pro-thrombotic/pro-coagulant environment via expression of endothelial-activating proteases and histones, as well as the expression and presentation of functional tissue factor³⁷.

Why should we focus on the risk of Hridroga (cardiovascular diseases) in Amavata patients living in the coastal area?

- People living in coastal areas face various challenges in health, healthcare, and quality of life, as some are remote and inaccessible. Due to remoteness, many coastal areas have yet to receive enough health services whenever needed. The environment influences the health of the population positively and negatively. Nevertheless, there are several factors contributing potential negative impact to the coastal population^{38,39,40,41}.
- The lack of progress in healthcare facilities and other associated resources has resulted in difficult access to these services, low health awareness and health inequalities between coastal, non-coastal and urban population.^{42,43} These, in turn, can result in poor health and poor quality of life among the coastal communities, which may lead to numerous negative health consequences⁴⁴. Data from Numerous studies Prevalence of RA is greater in coastal population than other geograph-

ical areas. In coastal areas, rheumatoid arthritis (RA) remains a seriously under-prioritized disease, particularly among the underprivileged, often resulting in presentation of patients late in the course of their disease, further complicated by limited therapeutic options and inconsistent follow up. The consequences are often severe with irreversible disability, increased frequency of comorbidities, especially cardiovascular disease (CVD), and higher mortality rates. Despite addressing traditional cardiovascular risk factors, the impact of subclinical or 'residual' inflammation from uncontrolled RA needs to be considered.

- According to Acharya Charaka, Desha is a habitat (clime) meaning geographic region⁴⁵. It is one of the factors which have to be assessed in ascertaining the Hetu (etiological factors) and also in deciding the treatment. Desh pariksha has been mentioned under Dashavidha pariksha^{46,47}. Climate, diseases, food, treatment and so many factors may vary according to it. Considering Charakokat types and description of Desh, Coastal areas resemble the anup desh where people are more prone to develop Aam and Kaphavata predominant diseases like Amavata. Coastal areas are Madhur ras and Vata- Kapha Dosha dominant sector^{48,49,50}.
- As most of the people from coastal areas are involved in fisheries, agriculture, oil and gas exploitation, tourism etc. where they need to spend a long time in cold and humid climates. While working in the coastal area, we came to observe that Aamvata patients have developed Hridroga (CVD) at high rates. The morbidity rate of Amavata patients due to cardiovascular events is high among them⁵¹.

CONCLUSION

An update on the fundamental descriptive epidemiology of the link between Aamvat and Hridroga has considerably added to our knowledge and understanding of the disease pathology. This will definitely prove helpful to find in future promising preventive,

diagnostic and therapeutic solutions for amavata and related risk in Hridroga among coastal populations. Accordingly, the quality of life of the Amavata patients can be enhanced, and the morbidity burden due to it can be reduced. Advances in anti-inflammatory treatment partly mitigate this risk by reducing the inflammation (aam). Amavata incidence and prevalence may be influenced by environmental differences, changes in diet and lifestyle. More research studies are needed over this topic.

REFERENCES

1. Acharya Vaidya Yadavaji Trikamji Editor (6th ed.). Madhukosha Sanskrit Commentary on Madhava Nidanam of Madhavakara (Vol 2), Chapter 25, Verse 10. p. 187.
2. Lindhardsen J, Ahlehoff O, Gislason GH, Madsen OR, Olesen JB, Torp-Pedersen C, et al. The risk of myocardial infarction in rheumatoid arthritis and diabetes mellitus: a Danish nationwide cohort study. *Ann Rheum Dis*. 2011;70(6):929–34. [PubMed] [Google Scholar]
3. Avina-Zubieta JA, Thomas J, Sadatsafavi M, Lehman AJ, Lacaille D. Risk of incident cardiovascular events in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Ann Rheum Dis*. 2012;71(9):1524–9. [PubMed] [Google Scholar]
4. Sekarningrum B, Yunita D. Socio-economic conditions of coastal communities and their implications to health behaviors. *Integr Bus Econ* 2019;8:195–201. [Google Scholar]
5. Kaviraj Dr. Ambikadatta Shashtri :Sushruta Samhita, Doshdhatumala Vidhnyan, Garbhavyakaran Shariram Chaukhamba Prakashan, Varanasi: Vol.-I : Reprint 2011: uttarantra 1/25.
6. Acharya Vaidya Yadavaji Trikamji Editor (6th ed.). Madhukosha Sanskrit Commentary on Madhava Nidanam of Madhavakara (Vol 2), Chapter 25, Verse 4-5. Varanasi: Chaukhamba Orientalia, 2001; p. 187.
7. Acharya Vaidya Yadavaji Trikamji Editor (6th ed.). Madhukosha Sanskrit Commentary on Madhava Nidanam of Madhavakara (Vol 2), Chapter 25, Verse 7. p. 187.
8. Acharya Vaidya Yadavaji Trikamji Editor (6th ed.). Madhukosha Sanskrit Commentary on Madhava Nidanam of Madhavakara(Vol 2), Chapter 25, Verse 1. p. 186.
9. Madhav Nidana, Madhukosha Commentary by Ayurvedacharya Shriyadunandupadhyaya, Reprint Purvardha, Chapter 1, Verse 4. Varanasi: Chaukhamba prakashan, 2012.
10. Agnivesha, Charaka Samhita (Revised by Charak and Dridhabala) with Vidyotini Hindi Commentary edited

- by Kashinath shastri and Dr. Goraknath Chaturvedi, Reprint ed. Nidanasthana: Chapter 1, Verse 44. Varanasi Chaukhamba Bharti Academy, Sutrasthana, 2009; 15.
11. Tanpure JS, Khedkar AD. Nidan Panchaka and Chikitsa of Amavata Vyadhi – A Critical Review. International Journal of Research in Ayurveda and Medical Sciences 2021; 4 (1): 14-21. DOI: <http://dx.doi.org/10.51446/IJRAMS.2021.4104>.
 12. Harsh Mohan; Rheumatoid Arthritis; The Musculoskeletal System, Textbook of pathology; 5th edition; Jaypee brothers; medical publishers (p) Ltd ,New Delhi, chapter- 26, page no. 876-878
 13. Alarcon GS. Epidemiology of rheumatoid arthritis. Rheumatic Diseases Clinics of North America 1995;21(3):589- 604. [PubMed] [Google Scholar]
 14. Almutairi, K.; Nossent, J.; Preen, D.; Keen, H.; Inderjeeth, C. The global prevalence of rheumatoid arthritis: A meta-analysis based on a systematic review. *Rheumatol. Int.* 2021, 41, 863–877. [Google Scholar] [CrossRef] [PubMed]
 15. Elena Bartoloni et al. Rheumatology Unit, Department of Clinical & Experimental Medicine, University of Perugia, Italy; volume 9,issue 10, August 2010, pages 701-707 <https://doi.org/10.1016/j.autrev.2010.06.001>
 16. V.G. Athyros et al. Prevalence of vascular disease in metabolic syndrome using three proposed definitions <https://doi.org/10.1016/j.ijcard.2006.04.078>
 17. Sherine E. Gabriel MD. Cardiovascular Morbidity and Mortality in Rheumatoid Arthritis; <https://doi.org/10.1016/j.amjmed.2008.06.011>
 18. Sherine E. Gabriel MD. Cardiovascular Morbidity and Mortality in Rheumatoid Arthritis; <https://doi.org/10.1016/j.amjmed.2008.06.011>
 19. Fatima F, Rao U, Moots R, Goodson N (2009) Raised traditional cardiovascular risk factors in Indians with rheumatoid arthritis. *Arthritis Rheum* 60 (S10), 948.
 20. Avina-Zubieta JA, Choi HK, Sadatsafavi M, Etminan M, Esdaile JM, Lacaille D (2008) Risk of cardiovascular mortality in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Arthritis Rheum* 59, 1690–7.
 21. Goodson NJ, Wiles NJ, Lunt M et al. Increased mortality in seropositive patients during the early years of inflammatory polyarthritis [abstract]. *Rheumatology* 2001;40(Suppl. 1):71.
 22. Monson RR, Hall AP. Mortality among arthritics. *J Chron Dis* 1976;29:459–67. Several meta-analyses have indicated an increased chance of CV death in RA patients by 50–60%.
 23. Avina-Zubieta, J.A.; Choi, H.K.; Sadatsafavi, M.; Etminan, M.; Esdaile, J.M.; Lacaille, D. Risk of cardiovascular mortality in patients with rheumatoid arthritis: A meta-analysis of observational studies. *Arthr. Rheum.* 2008, 59, 1690–1697. [Google Scholar] [CrossRef]
 24. Meune, C.; Touze, E.; Trinquart, L.; Allanore, Y. Trends in cardiovascular mortality in patients with rheumatoid arthritis over 50 years: A systematic review and meta-analysis of cohort studies. *Rheumatology* 2009, 48, 1309–1313. [Google Scholar] [CrossRef][Green Version]
 25. E.E.; Fransen, J.; den Broeder, A.A.; Popa, C.D.; van Riel, P.L. The effect of disease duration and disease activity on the risk of cardiovascular disease in rheumatoid arthritis patients. *Ann. Rheum. Dis.* 2015, 74, 998–1003. [Google Scholar] [CrossRef]
 26. Solomon, D.H.; Reed, G.W.; Kremer, J.M.; Curtis, J.R.; Farkouh, M.E.; Harrold, L.R.; Hochberg, M.C.; Tsao, P.; Greenberg, J.D. Disease activity in rheumatoid arthritis and the risk of cardiovascular events. *Arthritis Rheumatol.* 2015, 67, 1449–1455. [Google Scholar] [CrossRef] [PubMed]
 27. Maradit-Kremers H, Nicola PJ, Crowson CS, Ballman KV, Gabriel SE. Cardiovascular death in rheumatoid arthritis: a population-based study. *Arthritis Rheum.* 2005;52(3):722–732. [PubMed] [Google Scholar]
 28. Targońska-Stepniak B, Drelich-Zbroja A, Majdan M. The relationship between carotid intima-media thickness and the activity of rheumatoid arthritis. *J Clin Rheumatol.* 2011;17(5):249–255. [PubMed] [Google Scholar]
 29. 14. Puttevels D, De Vusser P, Geusens P, Dens J. Increased cardiovascular risk in patients with rheumatoid arthritis: an overview. *Acta Cardiol.* 2014;69(2):111–118. [PubMed] [Google Scholar]
 30. 15. Gkaliagkousi E, Gavriilaki E, Doumas M, Petidis K, Aslanidis S, Stella D. Cardiovascular risk in rheumatoid arthritis: pathogenesis, diagnosis, and management. *J Clin Rheumatol.* 2012;18(8):422–430. [PubMed] [Google Scholar]
 31. Ku IA, Imboden JB, Hsue PY, Ganz P. Rheumatoid arthritis: model of systemic inflammation driving atherosclerosis. *Circ J.* 2009;73(6):977–985. [PubMed] [Google Scholar]
 32. Meyer PW, Hodkinson B, Ally M, Musenge E, Wadee AA, Fickl H. et al. Circulating cytokine profiles and their relationships with autoantibodies, acute phase reactants and disease activity in patients with rheumatoid arthritis. *Mediators Inflamm.* 2010;2010 158514. [PMC free article] [PubMed] [Google Scholar]
 33. Dessein PH, Solomon A, Woodiwiss AJ, Norton GR, Tsang L, Gonzalez-Gay MA. Marked independent relationship between circulating interleukin- 6 concentrations and endothelial activation in rheumatoid arthritis. *Mediators Inflamm.* 2013;2013 510243. [PMC free article] [PubMed] [Google Scholar]
 34. Habets KL, Trouw LA, Levarht EW, Korporaal SJ, Habets PA, de Groot P. et al. Anti-citrullinated protein antibodies contribute to platelet activation in rheuma-

- toid arthritis. *Arthritis Res Ther.* 2015;17:209. [PMC free article] [PubMed] [Google Scholar]
35. Florence JM, Krupa A, Booshehri LM, Allen TC, Kurdowska AK. Metalloproteinase-9 contributes to endothelial dysfunction in atherosclerosis via protease activated receptor-1. *PLoS One.* 2017;12(2):e0171427. [PMC free article] [PubMed] [Google Scholar]
36. Beinsberger J, Heemskerck JW, Cosemans JM. Chronic arthritis and cardiovascular disease: altered blood parameters give rise to a prothrombotic propensity. *Semin Arthritis Rheum.* 2014;44(3):345–352. [PubMed] [Google Scholar]
37. Stakos DA, Kambas K, Konstantinidis T, Mitroulis I, Apostolidou I, Arelaki S. et al. Expression of functional tissue factor by neutrophil extracellular traps in culprit artery of acute myocardial infarction. *Eur Heart J.* 2015;36(22):1405–1414. [PMC free article] [PubMed] [Google Scholar]
38. <https://creakyjoints.org/comorbid-conditions/rheumatoid-arthritis-heart-disease-increased-risk/>.
39. <https://www.healthline.com/health/rheumatoid-arthritis/facts-statistics-infographic>
40. Madhava Nivana, by Madhavakara with Madhukosha commentary by Vijayarakshita and Srikantha Datta and extracts from Atanka Drapana by Vachaspati Vaidya edited by Vaidya Yadavji Trikamji Acharya, Chaukhambha Orientalia, reprint 25/24.).
41. Völker S, Kistemann T. The impact of blue space on human health and well-being -salutogenetic health effects of inland surface waters: a review. *Int J Hyg Environ Health* 2011; 214:449 –60. [PubMed] [Google Scholar]
42. White MP, Alcock I, Wheeler BW, et al. Coastal proximity, health and well-being: results from a longitudinal panel survey. *Health Place* 2013;23:97–103. [PubMed] [Google Scholar]
43. Peng C, Yamashita K, Kobayashi E. Effects of the coastal environment on well-being. *J Cost Zone Manag* 2016;19:1–7. [Google Scholar]
44. Wheeler BW, White M, Stahl-Timmins W, et al. Does living by the coast improve health and fwe. *Health Place* 2012;1198–201 [PubMed] [Google Scholar].
45. Agnivesha, Charaka Samhita Chakrapani Commentary, edited by Jadavaji Trikamji Acharya, Vimana Sthana 8/92, Chakrapani Tika, Varanasi: Chaukhamba Sanskrit Sansthan, reprint 2009, page no. 276.
46. Charaksamhita Charak-chandrika Hindi commentary; dr. Brahmanand Tripathi; Chaukhambha Surbharti Prakashan Varanasi; Vimansthan 8/84; reprint 2002; Page no. Charaksamhita Charak-chandrika Hindi commentary; dr. Brahmanand Tripathi; Chaukhambha Surbharti Prakashan Varanasi; Vimansthan 8/93; reprint 2002; Page no. 757.
47. Charaksamhita Charak-chandrika Hindi commentary; dr. Brahmanand Tripathi; Chaukhambha Surbharti Prakashan Varanasi; Vimansthan 8/93; reprint 2002; Page no. 757
48. Charaksamhita Charak-chandrika Hindi commentary; dr. Brahmanand Tripathi; Chaukhambha Surbharti Prakashan Varanasi; Vimansthan 8/84; reprint 2002; Page no. 755.
49. P. A. Nagdeve R. K. Golghate: 'Critical study of Konkani territory of Maharashtra state w.s.r. to the concept of Desha in Ayurveda'; Ayurline: International Journal of Research in Indian Medicine, e-ISSN: 2456-4435; Oct-Dec. 2021, Vol. 05th Issue: 4th: page no. 1-8.
50. Agnivesha, Charaka, Dridhabala, Charaka Samhita, Kalpa Sthana, Madanakalpa . In: 1/8. 1st ed. Yadavaji Trikamji Acharya., editor. Varanasi: Chaukhambha Surbharathi Prakashana; 2011. p. 653. [Google Scholar].
51. Kaviraj Dr. Ambikadatta Shashtri :Sushruta Samhita, Doshdhatumala Vidhnyan, Garbhavyakaran Shariram Chaukhamba Prakashan, Varanasi: Vol.-I : Reprint 2011: uttartastra 1/25.

Source of Support: Nil

Conflict of Interest: None Declared

How to cite this URL: Ravi Golghate et al: Risk of hridroga (cardiovascular disorder) in amavata patients (rheumatoid arthritis) among coastal population: a healthcare challenge. *International Ayurvedic Medical Journal* {online} 2023 {cited December 2023} Available from: http://www.iamj.in/posts/images/upload/2999_3005.pdf