IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

Literature Survey on Sub-Groups of Children with Kawasaki Disease a Data-Driven Cluster Analysis

Ms. Tanvi R[1], Ms. Vibha B R[2], Dr. Manjunath S[3]
Undergraduate Students, Department of Information Science and Engineering[1,2]
Professor, Department of Information Science and Engineering[3]
Global Academy of Technology, Bangalore, India

Abstract: *A notable childhood vasculitis that has a high risk of cardiovascular problems is Kawasaki illness. Despite being first identified in 1967 by fever and mucocutaneous irritation, it has since shown a variety of symptoms, the most serious of which is coronary artery aneurysms. Its complicated etiology is influenced by the interaction of environmental stimuli and genetic predisposition. Current multi omic research has shown unique patient profiles with varying host reactions. Factors such as age, gender, ethnicity, inflammatory indicators, and early coronary dilatation are linked to varying risks of coronary artery aneurysms. Clinical management is guided by the categorization of patients into complete or incomplete Kawasaki illness. We seek to identify subgroups using data-driven cluster analysis, improving comprehension for accurate patient treatment and research.*

Keywords: Hierarchical Clustering, K-Means Clustering, DBSCAN clustering, Gaussian Mixture Machine Learning, ML techniques

I. INTRODUCTION

Cardiovascular difficulties in children can be attributed in wide portion to the well-known juvenile vasculitis known as Kawasaki illness. It was first identified in 1967, but since then, it has been known to show in a variety of ways, with coronary artery aneurysms being the main cause for concern. Other symptoms include fever and mucocutaneous irritation. The complicated etiology of this condition is attributed to the intricateengagementamong genetic predilection stimuli. More recently, multi-omic studies have revealed unique patient profiles with varying host reactions. The risk of congestive heart failure aneurysms varies depending on factors like age, gender, ethnicity, inflammatory indicators, and early coronary dilatation. Clinical management is guided by classifying patients as having complete or incomplete Kawasaki disease. Our goal is to identify subgroups through data-driven cluster analysis, which will improve knowledge for accurate patient care and promote more in-depth scientific study.

II. LITERATURE SURVEY

2.1 Mining incomplete clinical data for the early assessment of Kawasaki disease based on feature clustering and convolutional neural networks.

This study investigates data-driven methods for structured electronic health records (EHRs)-based on early Kawasaki disease (KD) assessment. For better KD diagnosis, a two-stage approach that makes use of imperfect and multisource clinical data is suggested. Convolutional neural networks (CNNs), in particular, are machine learning techniques that are used to handle complicated, heterogeneous features and deal with incomplete data. Although CNN is famous for its ability to diagnose images, its use in hospital data mining is still relatively new. The study evaluates the efficacy of CNN-based feature extraction and matrix-based multi-view representation against benchmark approaches and shows how EHRs can enhance clinical decision-making for particular diseases. Though promising, the suggested approach has certain drawbacks, such as possible data bias in single-center data and higher processing demands than with conventional statistical techniques. Future uses might entail creating intelligent systems.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

2.2. Sociodemographic profile of children with Kawasaki disease in North India.

Comparing children suffering Kawasaki in North India to those with other rheumatologic disorders, this study looks into the socioeconomic characteristics of the former group. Enrolling 100 consecutive KD cases, the study used the Aggarwal scale for socioeconomic assessment and was accordingly on clinical observations spanning 18 years. Significant relationships were found by univariate analysis between KD and characteristics such as male sex, greater parental education, living in an urban area, having had all recommended vaccinations, and higher Aggarwal scale scores. Multivariate research, however, revealed that the only factors substantially connected with KD were male sex and living in an urban area. According to the study, families with children who have KD in North India might have a more advantageous sociodemographic profile than families with children who have other pediatric rheumatologic illnesses. Conclusive results require additional multicentric investigations.

2.3 Multisystem Inflammatory Syndrome in Children and Kawasaki Disease: A Spectrum of Postinfectious Hyperinflammatory Disease.

Kawasaki Disease (KD) and other postinfectious autoimmune/hyperinflammatory illnesses are receiving more attention as an outcome of the advent of Multisystem Syndrome in Children (MIS-C). The rash, alterations in the oral mucosa, and palmar erythema are clinical ailment that are analogous to each other. Uveitis and coronary aneurysms can occur in patients with both MIS-C and KD; shock syndrome has been reported in both conditions, albeit it is more uncommon in KD patients. While taking into account the possibility of volume overload in ventricular dysfunction, early treatment with steroids and intravenous immunoglobulin is advised in instances that fit the criteria for both KD and MIS-C. Since shock is frequent in MIS-C patients and more than 50% may need critical care, close observation is essential. The evaluation of cardiac involvement requires echocardiography.

2.4 Profile of Children with Kawasaki Disease Associated with Tropical Infections.

Infected with dengue, chikungunya, SARS-CoV-2, hepatitis A, tuberculosis, brucellosis, disseminated staphylococcal sepsis, scrub typhus, and enteric fever, eight boys and two girls, aged one month to eleven years, were recognized with Kawasaki. The data demonstrate how viral triggers are linked to KD. Even during situations where people are obtaining adequate medication, the study highlights the significance of taking KD into account while treating feverish patients with mucocutaneous involvement or nonresponsive sepsis.

2.5 Diagnosis of Kawasaki Disease.

Carotid arteries are the main target of Kawasaki Disease (KD), a medium vessel vasculitis. Lacking a conclusive laboratory test, KD's diagnosis is based solely on clinical findings. The 2017 recommendations from the American Heart Association (AHA) provide a framework for diagnostic criteria, however, it can be difficult to diagnose KD, especially in newborns and young children whose presentations are partial or peculiar. This review highlights the critical role echocardiography plays in the diagnosis and handling of children with KD and lays out the stages involved in attaining that diagnosis

2.6 Multisystem inflammatory syndrome in children: Is there a linkage to Kawasaki disease?

Since its discovery in 1967, Kawasaki Disease (KD) has emerged as a major contributor to childhood-acquired coronary artery disease. It is a pediatric inflammatory condition. Children's Inflammatory Syndrome which has links to KD, has gained attention due to the COVID-19 generic. The history of KD, its long-term consequences for anomalies in the coronary arteries, and the advent of MIS-C amid the COVID-19 generic are all examined in this research. The paper explores potential connections between KD, pediatric COVID-19, and MIS-C. A precise etiology for KD remains unknown despite substantial breakthroughs in KD care.

2.7 Subgroups of children with Kawasaki disease: a data-driven cluster analysis.

A data-driven strategy was used in the study at Rady Children's Hospital to identify clinical subgroups within Kawasaki illness. Information from peoplerecognized between 2002 and 2022 were evaluated, and the patients were grouped according to several clinical factors. Hepatobiliary involvement, high neutrophil count and shock rates, cervical

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

lymphadenopathy with inflammatory markers, and young age with huge chances of coronary artery aneurysms are the four separate categories that stood out for their own reasons. Different seasonal patterns and incidence rates were observed in every category. The subgroups' similar and unique profiles were recognised through proteomic analysis. The heterogeneity of Kawasaki disease is clarified by this study, offering guidance for clinical therapy and future research directions. The Irving and Francine Suknow Foundation and the US National Institutes of Health provided funding.

2.8 Kawasaki Disease Patient Stratification and Pathway Analysis Based on Host Transcriptomic and Proteomic Profiles.

The study compared the host-omics profiles with those of bacterial and viral infections in order to uncover the underlying processes of Kawasaki disease (KD), an acute juvenile inflammatory condition. Analysis showed that KD patients have activated anti-bacterial and anti-viral mechanisms. Although infections were seen with KD patients, other patients showed diverse transcriptome profiles, indicating a different triggering mechanism. Three KD patient clusters were found using clustering, demonstrating variation in the inflammatory response. The results suggest that different infections or a single disease with different host-specific symptoms could cause KD. While parallels between the reactions of bacteria and viruses were noted, variations point to a new mechanism for KD initiation. The bulk of KD samples had non-bacterial, non-viral characteristics, which may have indicated different triggers. This validated the theory.

2.9 Kawasaki Disease: an update.

Updates on Kawasaki disease (KD) show improvements in treatment for IVIG-refractory cases as well as the emergence of a KD-like condition that is linked to COVID-19. KD, which mainly affects children under five, has no known cause but is thought to be immune-mediated inflammation in genetically predisposed individuals brought on by an unidentified stimulus. Analytical data are used for diagnosis; incomplete cases are referred to as atypical KD. Even in cases of atypical KD, coronary artery anomalies are the most seen cause for concern. Administration of aspirin with IVIG dramatically lowers the incidence of coronary lesions. In more complex instances, immune-modulating treatments are being used. Since KD was first identified in 1967 in Japan, instances have been seen throughout the world, highlighting the disease's extensive effects.

2.10 Kawasaki disease: pathophysiology and insights from mouse models.

Unknown severe fever sickness known as "Kawasaki disease" strikes young children and frequently results in coronary artery aneurysms and long-term cardiovascular problems. In youngsters in the US, it is a dominant element of cardio disease. Medication lowers the risk of coronary aneurysms, although certain cases are resistant to the medication, which raises the possibility of coronary damage. Because ofless precise tests or biomarkers, diagnosis is difficult. The pathophysiology and immunological mechanisms of the ailment have been exceptionally known thanks to experimental mice models, which has aided in the creation of novel treatments. This synopsis highlights the intricacy of the illness, the difficulties in diagnosing it, and the critical role that experimental models play in developing new treatment approaches.

2.11 Kawasaki disease or Kawasaki syndrome?

Because there were fewer documented instances of the COVID-19 pandemic among children, and because those cases were usually mimimalthan those in adults, pediatricians were initially less active in the early phases of the outbreak. However, in areas severely impacted by COVID-19, there was a notable rise in children and adolescents displaying an acute hyperinflammatory condition akin to Kawasaki syndrome between April and May 2020. These patients frequently needed immediate intensive care since they had unusual symptoms such diarrhea, stomach pain, and heart failure. A few experienced indications of macrophage activation syndrome or toxic shock syndrome. Also, to lymphopenia and thrombocytopenia, indicators of inflammation such as increased CRP, IL-6, D-dimer, and ferritin levels were frequently observed. IVIG and glucocorticoids were used as anti-inflammatory treatments, and some patients also received additional inhibitors.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

2.12 Kawasaki Disease: Global Burden and Genetic Background.

Kawasaki is a juvenile vasculitis that mostly affects the coronary arteries. It is becoming more commonplace globally, especially in countries that are industrializing quickly. Although the precise etiology is yet unknown, immunological and environmental variables most likely interact with a hereditary susceptibility. The frequency of the disease varies greatly by area, with the greatest rates reported in North-East Asian nations. Intravenous immunoglobulin treatment and early identification are essential to avert major consequences such as coronary artery lesions. Genetic research has revealed susceptibility genes and changes in DNA methylation that affect the prognosis and pathophysiology of KD. The global epidemiological trends of KD and the genetic variables driving its development are highlighted in this summary.

2.13 Kawasaki disease and allergic diseases.

Kawasaki disease (KD), which is typified by coronary vasculitis and inflammation of unclear etiology, is a primary reason of cardio disease in children. Although earlier research suggested a possible connection between KD and allergy disorders, the data has not yet undergone a thorough analysis. This uses information from clinical, epidemiological, and immunological repertoire research to investigate the relationship between KD and allergies. Allergies usually entail immunological reactions brought on by allergens, although KD and viral disorders do have some traits. In contrast to the general population, children with KD are highlyprone to experience allergic rhinitis and urticaria. The study proposes strategies to manage allergies in KD patients and highlights the significance of taking allergy disorders into account in the long-term management of these patients.

2.14 Antibodies and Immunity During Kawasaki Disease.

The primary reason forcardio disease in children, Kawasaki disease (KD), has an enigmatic etiology. Studies on epidemiology provide evidence that an infectious condition is responsible for initiating the inflammatory cascade that is triggered by KD. Epidemiology provides evidence that humoral immunity may offer some protection. It is still unknown, nevertheless, how the immune system—specifically, B cells and antibodies—plays a part in the pathophysiology of KD. Coronary aneurysms can be prevented by intravenous immunoglobulin (IVIG) and other medicines that aim to modulate inflammation. Children with KD have been documented to possess a variety of autoantibody reactions, and infiltrates of aneurysmal plasma cells have produced antibodies. According to recent research, kids with KD exhibit plasmablast responses that are comparable to those of kids with other infectious disorders.

2.15 Neurological involvement in Kawasaki disease: a retrospective study.

Kawasaki is a type thatprimarily influence children. Complications of KD is known to be neurological involvement. 5.1% of the 1582 KD patients in this paper had neuro based problem such as headache, seizures, and sleeplessness. Neurological involvement did not predict IVIG resistance or coronary artery lesions independently, despite increased rates of resistance and inflammatory markers in these instances. Even while neurological symptoms were not widespread, they were linked to moreload of inflammation. This shows the significance of identifying KD with neurological involvement and the necessity of routine IVIG therapy in these instances.

III. CONCLUSION

Data-driven cluster is used in the literature survey to identify distinct clinical profiles, such as hepatobiliary involvement and inflammatory markers, for sub-groups of children with Kawasaki illness. Along with newly discovered illnesses like pediatric multisystem inflammatory disease, socioeconomic variables, and genetic predispositions are emphasized. Notwithstanding the difficulties in diagnosing Kawasaki disease, data-driven methods provide insights into its intricate etiology and wide range of presentations, guiding customized treatment plans for improved results. This thorough knowledge highlights the importance of continued research and careful clinical management in pediatricvasculitides.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, February 2024

ACKNOWLEDGEMENT

We Thanks to our project co-ordinator Prof. Sharmila C and project guide Prof. Manjunath S for providing all support and information regarding project.

REFERENCES

[1]. Wang H, Tan X, Huang Z, Pan B, Tian J. Mining incomplete clinical data for the early assessment of Kawasaki disease based on feature clustering and convolutional neural networks. ArtifIntell Med. 2020 May;105:101859. doi: 10.1016/j.artmed.2020.101859. Epub 2020 May 3. PMID: 32505429.

[2]. Prakash J, Singh S, Gupta A, Bharti B, Bhalla AK. Sociodemographic profile of children with Kawasaki disease in North India. Clin Rheumatol. 2016 Mar;35(3):709-13. doi: 10.1007/s10067-014-2825-6. Epub 2014 Nov 22. PMID: 25413734.

[3]. Robinson LA, Dale M, Gorelik M. Multisystem Inflammatory Syndrome in Children and Kawasaki Disease: A Spectrum of Postinfectious Hyperinflammatory Disease. Rheum Dis Clin North Am. 2023 Aug;49(3):661-678. doi: 10.1016/j.rdc.2023.03.003. Epub 2023 Apr 15. PMID: 37331739.

[4]. Mahajan A, Yadav S, Maheshwari A, Mahto D, Divya K, Ackshaya R, Meena H, Shakya S, Kumar V. Profile of Children with Kawasaki Disease Associated with Tropical Infections. Indian J Pediatr. 2022 Aug;89(8):759-764. doi: 10.1007/s12098-021-03953-9. Epub 2021 Dec 22. PMID: 34935098; PMCID: PMC8691965.

[5]. Singh S, Jindal AK, Pilania RK. Diagnosis of Kawasaki disease. Int J Rheum Dis. 2018 Jan;21(1):36-44. doi: 10.1111/1756-185X.13224. Epub 2017 Nov 13. PMID: 29131549; PMCID: PMC7159575.

[6 Loke YH, Berul CI, Harahsheh AS. Multisystem inflammatory syndrome in children: Is there a linkage to Kawasaki disease? Trends Cardiovasc Med. 2020 Oct;30(7):389-396. doi: 10.1016/j.tcm.2020.07.004. Epub 2020 Jul 20. PMID: 32702413; PMCID: PMC7370900.

[7]. Wang H, Shimizu C, Bainto E, Hamilton S, Jackson HR, Estrada-Rivadeneyra D, Kaforou M, Levin M, Pancheri JM, Dummer KB, Tremoulet AH, Burns JC. Subgroups of children with Kawasaki disease: a data-driven cluster analysis. Lancet Child Adolesc Health. 2023 Oct;7(10):697-707. doi: 10.1016/S2352-4642(23)00166-9. Epub 2023 Aug 17. PMID: 37598693; PMCID: PMC10756500.

[8]. Jackson H, Menikou S, Hamilton S, McArdle A, Shimizu C, Galassini R, Huang H, Kim J, Tremoulet A, Thorne A, Fischer R, de Jonge MI, Kuijpers T, Wright V, Burns JC, Casals-Pascual C, Herberg J, Levin M, Kaforou M, On Behalf Of The Perform Consortium. Kawasaki Disease Patient Stratification and Pathway Analysis Based on Host Transcriptomic and Proteomic Profiles. Int J Mol Sci. 2021 May 26;22(11):5655. doi: 10.3390/ijms22115655. PMID: 34073389; PMCID: PMC8198135.

[9]. Rife E, Gedalia A. Kawasaki Disease: an Update. Curr Rheumatol Rep. 2020 Sep 13;22(10):75. doi: 10.1007/s11926-020-00941-4. PMID: 32924089; PMCID: PMC7487199.

[10]. Noval Rivas M, Arditi M. Kawasaki disease: pathophysiology and insights from mouse models. Nat Rev Rheumatol. 2020 Jul;16(7):391-405. doi: 10.1038/s41584-020-0426-0. Epub 2020 May 26. PMID: 32457494; PMCID: PMC7250272.

[11]. Ravelli, Angelo, and Alberto Martini. "Kawasaki disease or Kawasaki syndrome?." Annals of the Rheumatic Diseases 79.8 (2020): 993-995.

[12]. Elakabawi, Karim, et al. "Kawasaki disease: global burden and genetic background." Cardiology Research 11.1 (2020): 9.

[13]. Huang, Po-Yu, et al. "Kawasaki disease and allergic diseases." Frontiers in Pediatrics 8 (2021): 614386.

[14]. Hicar, Mark Daniel. "Antibodies and immunity during Kawasaki disease." Frontiers in Cardiovascular Medicine 7 (2020): 94.

[15]. Liu, Xiaoliang, et al. "Neurological involvement in Kawasaki disease: a retrospective study." Pediatric Rheumatology 18.1 (2020): 1-8