

# Exploring the Role of Patient Education by Nurses in Improving Hypertension Medication Adherence: A Narrative Review

DIVYA JAIN<sup>1</sup>, SAPNA BHAVIN PATEL<sup>2</sup>

## ABSTRACT

Hypertension is one of the major global health issues contributing to cardiovascular morbidity and mortality. Despite the availability of effective pharmacological treatments, many patients struggle with adhering to their medication regimens, especially for chronic conditions like hypertension. Nurses can play a crucial role in improving patients' compliance with antihypertensive medications through focused instruction and support. The present narrative review evaluated Randomised Controlled Trials (RCTs) and quasi-experimental studies to assess the impact of nurse-led educational interventions on medication adherence among patients with hypertension. The findings indicate that these interventions significantly enhance the medication adherence and lead to better management of hypertension. Incorporating nurse-led educational interventions into standard care can greatly improve the management of chronic diseases. Future research should focus on integrating digital tools for ongoing support, standardising interventions, and involving diverse populations.

**Keywords:** Cardiovascular disorder, Nurse-led interventions, Patient compliance

## INTRODUCTION

Despite being relatively easy to detect and often controllable with inexpensive, effective medications, arterial hypertension-also known as elevated blood pressure-remains the leading cause of Cardiovascular Diseases (CVD) and mortality worldwide. While some improvements have been observed primarily in high-income countries, a recent survey found that hypertension detection and control remain low in many parts of the world, especially in low-income countries [].

Hypertension is a significant global health issue. In both developed and developing nations, uncontrolled hypertension continues to present serious medical and psychological challenges. Although the risk factors, prevention, and control measures for hypertension are widely recognised, the negative effects of the disease can last for years. Consequently, hypertension ranks among the most serious health and social issues. Patients may only experience the greatest benefits from a suitable treatment plan if they rigorously adhere to the prescribed regimen [].

Hypertension leads to vascular damage and increases cardiac workload. As a result, it can lead to a variety of significant medical disorders, such as congestive heart failure, stroke, and renal failure. These conditions increase the utilization of healthcare resources and services, thereby raising healthcare-related expenses [3].

Several factors have been proposed to explain these disappointing results, including flaws in healthcare systems and issues with access to care in certain countries. In industrialised nations, other concerns have been identified as key contributors to poor blood pressure control, with the most common being poor adherence to and persistence with recommended medications, as well as therapeutic inertia. In a meta-analysis of 27 million patients with elevated blood pressure, non-adherence to medications emerged as a major cause of uncontrolled hypertension, a problem that is particularly widespread in low-income countries [4].

"Medication adherence is the degree to which an individual takes medication in compliance with established recommendations from a healthcare provider," as defined by the World Health Organisation (WHO) [5]. In addition to genetic and environmental risk factors, social determinants of health also impact hypertension. "The

circumstances in which people are born, grow, live, work, and age, as well as the systems designed to deal with disease," provide a broad definition of the social determinants of health. Utilising both non-pharmacologic and pharmaceutical therapies to lower blood pressure to non-hypertensive levels in individuals with hypertension decreases their risk of CVD, which accounts for 20% to 40% of deaths. To effectively lower blood pressure and reduce the risk of CVD, treatments must be adhered to and adjusted [6].

Following the prescribed treatment plan for high blood pressure is a challenging and complex task. A thorough study of the reasons why patients do not adhere to their treatment plans could help healthcare professionals, particularly nurses, develop personalised nursing interventions to assist patients in sticking to their treatment regimens [7].

Nurses play a critical role in medication management and adherence. They significantly improve patient outcomes by providing comprehensive care management, which includes medication education, monitoring physiological conditions, and assisting with patient recovery and safety. Nurses must possess a thorough understanding of safe medication administration and adverse drug reactions to swiftly identify and resolve potential issues [8].

Nurses' efforts to address pharmaceutical nonadherence should focus on the underlying causes of nonadherence and should include interventions tailored to patients' needs and preferences. Nursing interventions may include offering guidance and education alongside the teach-back method, proposing and implementing a feasible medication regimen, simplifying doses and schedules, and involving family members in medication management [9].

This review aims to conduct a thorough literature search to evaluate the role of nursing interventions on medication adherence among patients with hypertension.

## Different Methods to Enhance Medication Adherence

The ultimate goal is the patient's outcome, which surpasses the desirability of 21st-century medical technological advancements, as well as the complexities of drug discovery, informed prescribing, and pharmaceutical delivery. Patient outcomes encompass the course of illness, disease investigation, and medication use,

including symptom persistence, recurrence, and remission, as well as emergency room visits, hospitalizations, readmissions, safety, efficacy, timeliness of care, and morbidity and mortality [10].

It is important to note that pharmaceutical non-adherence has both financial and human consequences, including detrimental effects on the patient's health and increased demand on healthcare services. Additionally, poor control of hypertension may result from noncompliance with the treatment regimen [11].

Given that poorly managed hypertension is linked to inadequate blood pressure control, which can lead to cardiovascular issues, non-adherence to antihypertensive treatment can have serious repercussions. While lifestyle changes can help normalise blood pressure and prevent some forms of hypertension, a combination of medication and lifestyle modifications may be necessary for more severe cases of hypertension [12].

### Individualised/Patient-Centered Education

Educational initiatives that inform patients about previously prescribed drug regimens often lead to better medication adherence and increased patient awareness. These interventions are most effective at enhancing patient-centered outcomes such as knowledge, self-efficacy, and self-monitoring skills. The most successful educational strategies combine patient education, coaching, behavioral support, and social support [13].

The goal of patient-centered care is to involve patients in their own care and treatment. One of the most effective treatments in this area involves educating and following up with patients after they have been discharged from the hospital, which is critical for their rehabilitation. Education plays an important role in the care programs for chronic diseases, as it helps patients cope with their current state and encourages them to actively participate in their own care [14].

### Structured Health Education Programs

A new approach to care for low-income populations is the nursing intervention "Teaching: Individual," which improves adherence to treatment plans for patients with Type 2 Diabetes and/or hypertension. District health system managers and officials will learn from this study how effective this intervention is. If successful, it could be widely implemented in cardiovascular risk programs [15].

### Theory-Based Educational Interventions

Studies on theory-based interventions have shown decreased effectiveness in adherence behavior. To enhance the effectiveness of individualised education, a theory-based study employed supportive strategies. A variety of concepts were explored in these studies, including the health promotion model and Roy's adaptation theory [16].

Well-known behavioral theories, such as Roy's Adaptation Model and the Health Belief Model, are utilised in these interventions. They assist nurses in developing instruction that focuses on attitudes, beliefs, and coping strategies. Theory-based methods improve understanding of illness and treatment as well as boost internal motivation. These models contribute to behavior change and improved medication compliance, helping to organise interventions for predictable and repeatable outcomes.

### Case Management/Comprehensive Nursing Care

Numerous nursing services-such as consultations, home visits, phone follow-ups, and health education-are integrated into this model. It ensures ongoing, well-coordinated care tailored to the needs of the patient.

In a study assessing the impact of theoretical education on medication adherence among the elderly with hypertension, nearly

half of the participants in the experimental group demonstrated good adherence to the blood pressure-controlling medication regimen, significantly improving compared to before the educational intervention. In contrast, the control group showed no significant changes in medication compliance [17]. Another study corroborated this finding, indicating that the peer education group adhered to treatment more effectively than the staff training group during a two-month follow-up [18].

### Peer and Multidisciplinary Support-Based Education

These interventions may involve peers, family members, or multidisciplinary teams to help and educate patients. They utilise role modeling and social support to enhance understanding and motivation. Programs include peer education, family involvement, and reminders via electronic pillboxes. Research has shown better blood pressure control and adherence with these strategies, particularly in resource-limited and community-focused settings.

One study found that peer education is more effective than healthcare provider education in enhancing medication adherence among individuals with high blood pressure [19]. Additionally, a study examining the effects of peer education on the physical and psychological outcomes of patients with coronary artery disease found that peer education was more effective in reducing anxiety among these patients than standard education [20].

### Challenges and Barriers Faced by Nurses

Patients' forgetfulness, fear of treatment side effects, low motivation due to perceived ineffectiveness, low health literacy, hostility toward the health belief model, and stigmatization are the main reasons for poor adherence [21].

Other contributing issues may include excessive medication costs and limited patient-provider communication. Beyond harming individual health, widespread non-compliance can significantly impact community health, particularly concerning communicable diseases [22].

Additionally, a study identified challenges in medication adherence, including complicated regimens, low literacy, forgetfulness, and a lack of awareness. Facilitators of adherence included medication refills, frequent monitoring, patient counseling, and easy access to the healthcare system [23].

In contrast to practical factors, which are primarily external environmental elements related to the individual, treatment, or society that influence behavior, perceptual factors originate mainly from internal cognitive processes, such as motivation, emotions, and patient perceptions and beliefs regarding their illness and treatment [24].

When addressing any healthcare issue or behavior, it is crucial to first identify and evaluate the contributing causes to create targeted interventions aimed at reducing or eliminating them. While no single type of adherence intervention has been conclusively proven more successful than others in enhancing adherence [25], several approaches such as peer education, nurse case management, the use of electronic health data, and structured models (like Roy's Adaptation Model and the Health Belief Model) have been explored. Overall, most studies demonstrated improvements in blood pressure control and/or medication adherence, emphasising the effectiveness of nursing-led approaches in hypertension management [Table/Fig-1].

## DISCUSSION

The present narrative review combines traditional and digital methods in nursing interventions for medication adherence to offer comprehensive support. Traditional approaches, including peer education, culturally sensitive instruction, individualised education,

S. No.	Author(s)	Year	Country	Study design	Population	Educational intervention by nurses	Adherence outcome
1	Mayhob MM and Hashim S [26]	2019	Egypt	Quasi Experimental	84	Individualised nursing intervention	Individualised nursing interventions are very effective at getting patients to stick to their hypertension treatment plans by finding and fixing the things that keep each patient from following the plan as it is supposed to be.
2	Kolcu M and Ergun A [27]	2020	Turkey	RCT	74	The training program includes 20 weeks of health classes and seminars to motivate people.	Training program shown good effect on intervention group than control group. when it came to knowing about high blood pressure, taking their medications (100.0%)
3	Delavar F et al., [28]	2020	Iran	RCT	118	Self-management education tailored to health literacy	The intervention resulted in a large decrease in systolic and diastolic blood pressure ratings, as well as increased medication adherence ( $p<0.05$ ).
4	Marseille BR et al., [29]	2021	USA	Quasi Experimental		Culturally targeted instruction aimed at increasing understanding, medication adherence, and blood pressure.	The systolic and diastolic pressures significantly decreased six weeks after the intervention. Knowledge about hypertension and medication adherence improved.
5	Ranjbar H et al., [30]	2024	Iran	RCT	74	Peer education	Peer education programs are less costly than traditional health center instruction and help older adults with hypertension adhere to their medication regimens.
6	Mattei da Silva ÂT et al., [31]	2020	Brazil	RCT	94	The nurse case management paradigm incorporates nursing consultations, phone calls, home visits, health education, and appropriate referrals.	Blood pressure in intervention was at lower side compared to control group. The groups' respective systolic and diastolic blood pressure differences were -8.3
7	Zhang J et al., [32]	2021	China	RCT	120	Roy's adaptation model based intervention	Patients in the observation group scored higher on medication compliance
8	Yazdanpanah Y et al., [33]	2019	Iran	RCT	60	Health belief model based educational intervention	Compared to the control group ( $3.7\pm1.0$ ), the intervention group's post-test means medication adherence score was significantly higher.
9	Woodham NS et al., [34]	2020	Thailand	Quasi-experimental	200	Program for interdisciplinary intervention. An antihypertensive medication adherence education program, family-supportive hypertension care, community-based hypertension care, reminders for medicine, monthly count of medicine, and blood pressure checks are all part of this strategy.	In terms of blood pressure control, the full approach intervention performed better than the control group.
10	Parra DI et al., [35]	2021	Colombia	RCT	200	Educational interventions	The individual teaching intervention was effective in improving therapeutic adherence
11	Persell SD et al., [13]	2018	Chicago	RCT	794	Medication support using electronic health records and nurse-led therapy	EHR tools enhanced medication reconciliation while worsening blood pressure. Combining these technologies with nurse-led support resulted in increased knowledge of medication instructions and dosage.
12	Zhu X et al., [14]	2017	China	RCT	134	The nurse-led hypertension management paradigm	The nurse-led hypertension management strategy is feasible and useful for improving the outcomes of patients with uncontrolled blood pressure in the community.

**[Table/Fig-1]:** Overview of studies on nurse-led interventions for improving medication adherence in hypertensive patients [13,14,26-35].

EHR: Electronic Health Records

and nurse case management, aim to improve comprehension and motivation. Consistent medication use is reinforced through interdisciplinary collaboration and educational programs grounded in the health belief model.

Digital interventions employ tools like mobile apps, telehealth, nurse-led reminders, electronic health records, and patient portals to track, direct, and provide feedback. When combined, these strategies ensure technology-enabled, culturally sensitive, and individualised support for optimal adherence.

To explore how the health belief model might enhance Chinese patients' perceptions of adherence to hypertension treatments, a study was conducted. This study found that the health belief model had an 82.8% accuracy rate in predicting 48.8% of changes in medication adherence. The Health Belief Model (HBM) may significantly impact medication adherence among patients with hypertension [2].

An investigation into the effects of health belief model-based training on diabetic medication adherence found that the constructs of perceived susceptibility, perceived advantages, self-efficacy, and medication adherence performance improved significantly after the educational intervention compared to pre-intervention levels [36].

### Treatment Adherence in India

Treatment adherence in India varies depending on socioeconomic status, health literacy, and disease duration. Improving adherence necessitates a multifaceted approach that includes strategies from physicians, patients, and the healthcare system, alongside therapeutic innovations and lifestyle interventions. The emphasis on patient education, enhanced communication, greater healthcare access, and affordability is critical [37]. Despite advancements in medication, non-compliance remains an issue. Nurses play a vital role in educating, consulting, and monitoring patients, addressing

concerns such as side effects and lifestyle choices. A mixed-methods approach that includes both quantitative and qualitative data has been effective. Results indicate that nurse-led interventions increase adherence, blood pressure control, and patient involvement, contributing to the advancement of nursing roles in chronic illness care [38].

This review observed that patients' trust in nurses was lower than usual and that medication adherence was moderate among cardiovascular patients. When considering the type of disease as an unchangeable variable, the most significant modifiable factor in improving medication adherence in cardiovascular patients was nurse confidence. Therefore, to increase patient trust in nurses, practical steps such as teaching nurses communication skills and recruiting and training individuals with strong communication abilities should be implemented [21].

Several suggestions for further research and application can be made based on the conclusions of this review. To strengthen the body of evidence, more extensive, multicenter randomised controlled trials with standardised adherence measures are required. Future research should examine nurse-led interventions across various populations and settings, particularly in low-resource environments where adherence is often lower. Identifying patient perspectives and contextual barriers may be facilitated by incorporating qualitative elements. Furthermore, integrating digital tools like tele-nursing and mobile reminders could enhance the sustainability and reach of interventions. Lastly, training in behavior change communication and patient education techniques for managing chronic diseases should be emphasised in nursing education programs.

## CONCLUSION(S)

The present narrative review discusses the value of nurse-led educational interventions in improving medication adherence among hypertension patients. The results demonstrate that certain nurse-led interventions positively impact clinical outcomes and medication adherence in this patient population. The most effective elements of these interventions-such as patient education, case management, theory-based approaches, structured health education programs, tailored counseling, nurse-led medication support, electronic health record-based medication support, and peer or multidisciplinary support-should be the focus of future research.

## REFERENCES

- [1] NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: A pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet*. 2021;398(10304):957-80.
- [2] Yue Z, Li C, Weilin Q, Bin W. Application of the health belief model to improve the understanding of antihypertensive medication adherence among Chinese patients. *Patient Educ Couns*. 2015;98(5):669-73.
- [3] Koo M, Lu MC, Lin SC. Predictors of internet use for health information among male and female internet users: Findings from the 2009 Taiwan National Health Interview Survey. *Int J Med Inform*. 2016;94:155-63.
- [4] Lee EKP, Poon P, Yip BHK, Bo Y, Zhu MT, Yu CP, et al. Global burden, regional differences, trends, and health consequences of medication non-adherence for hypertension during 2010 to 2020: A meta-analysis involving 27 million patients. *J Am Heart Assoc*. 2022;11(17):e026582.
- [5] PAHO/WHO. Adherence to Long-Term Therapies: Evidence for Action. 2003. [Accessed 2023 October 10].
- [6] Carey RM, Muntner P, Bosworth HB, Whelton PK. Prevention and control of hypertension: JACC Health promotion series. *J Am Coll Cardiol*. 2018;72(11):1278-93.
- [7] Costa E, Giardini A, Savin M, Mendiito E, Lehan E, Laosa O, et al. Interventional tools to improve medication adherence: Review of literature. *Patient Prefer Adherence*. 2015;9:1303-14.
- [8] Alanazi AJ, Alqahtani FHS, Altamimi AN, Alshammari AB, Aldossari MN, Alshakrah SS, et al. The role of pharmacists, nurses, and medical practitioners in medication adherence and personalized medicine. *J Popul Ther Clin Pharmacol*. 2022;29(4):2047-54.
- [9] Hornes N, Larsen K, Boysen G. Blood pressure one year after stroke: The need to optimize secondary prevention. *J Stroke Cerebrovasc Dis*. 2011;20(1):16-23.
- [10] Aremu TO, Oluwole OE, Adeyinka KO, Schommer JC. Medication adherence and compliance: Recipe for improving patient outcomes. *Pharmacy (Basel)*. 2022;10(5):106.
- [11] Afaya RA, Bam V, Azongo TB, Afaya A, Kusi-Amponsah A, Ajusiye JM, et al. Medication adherence and self-care behaviors among patients with type 2 diabetes mellitus in Ghana. *PLoS ONE*. 2020;15(8):e0237710.
- [12] Charchar FJ, Prestes PR, Mills C, Ching SM, Neupane D, Marques FZ, et al. Lifestyle management of hypertension: International Society of Hypertension position paper endorsed by the World Hypertension League and European Society of Hypertension. *J Hypertens*. 2024;42(1):23-49.
- [13] Persell SD, Karmali KN, Lazar D, Friesema EM, Lee JY, Rademaker A, et al. Effect of electronic health record-based medication support and nurse-led medication therapy management on hypertension and medication self-management: A randomized clinical trial. *JAMA Intern Med*. 2018;178(8):1069-77.
- [14] Zhu X, Wong FKY, Wu CLH. Development and evaluation of a nurse-led hypertension management model: A randomized controlled trial. *Int J Nurs Stud*. 2018;77:171-78.
- [15] Romero Guevara SL, Parra DI, Rojas LZ. "Teaching: Individual" to increase adherence to therapeutic regimen in people with hypertension and type-2 diabetes: Protocol of the controlled clinical trial ENURSIN. *BMC Nurs*. 2019;18:22. Doi: 10.1186/s12912-019-0344-0. PMID: 31171916; PMCID: PMC6549360.
- [16] Kuntz JL, Safford MM, Singh JA, Phansalkar S, Slight SP, Her QL, et al. Patient-centered interventions to improve medication management and adherence: A qualitative review of research findings. *Patient Educ Couns*. 2014;97(3):310-26.
- [17] Conn VS, Ruppert TM, Chase JA, Enriquez M, Cooper PS. Interventions to improve medication adherence in hypertensive patients: Systematic review and meta-analysis. *Curr Hypertens Rep*. 2015;17(12):94.
- [18] Hachisanoglu R, Gozum S. The effect of patient education and home monitoring on medication compliance, hypertension management, healthy lifestyle behaviors, and BMI in a primary health care setting. *J Clin Nurs*. 2011;20(5-6):692-705.
- [19] Fakhri A, Morshedi H, Mohammadi Zeidi I. Effectiveness of theory-based education on medication adherence in older adults with hypertension. *Jundishapur Sci Med J*. 2017;16(2):161-74.
- [20] Alamdari A, Hosseini N, Ranjbar S, Roustaei N. Comparison of the effect of training by peers and healthcare staff on adherence to treatment in patients with hypertension. *J Clin Care Skills*. 2021;2(2):69-76.
- [21] Ruswati R. The role of nurses in enhancing medication adherence and patient outcomes in hypertension management. *Int J Nurs Midwifery Res*. 2024;2(3):78-87.
- [22] Aliasari Mamaghani E, Soleimani A, Zirak M. Trust in nurses and its association with medication adherence of cardiovascular patients: A descriptive correlational study. *Int J Nurs Stud Adv*. 2024;8:100278.
- [23] Iuga AO, McGuire MJ. Adherence and health care costs. *Risk Manag Healthc Policy*. 2014;7:35-44.
- [24] Horne R, Weinman J, Barber N, Elliott R, Morgan M, Cribb A. Concordance, adherence and compliance in medicine taking: Report for the National Coordinating Centre for NHS Service Delivery and Organisation R&D (NCCSDO). London: NCCSDO; 2005.
- [25] Nieuwlaar T, Wilczynski N, Navarro T, Hobson N, Jeffery R, Keepanasseril A, et al. Interventions for enhancing medication adherence. *Cochrane Database Syst Rev*. 2014(11):CD000011.
- [26] Mayhob MM, Hashim S. Individualized nursing intervention: Its effect on enhancing patients' adherence to hypertensive treatment plan. *Egyptian J Health Care*. 2019;10(4):285-98.
- [27] Kolcu M, Ergun A. Effect of a nurse-led hypertension management program on quality of life, medication adherence and hypertension management in older adults: A randomized controlled trial. *Geriatr Gerontol Int*. 2020;20(12):1182-89.
- [28] Delavar F, Pashaeypoor S, Negarandeh R. The effects of self-management education tailored to health literacy on medication adherence and blood pressure control among elderly people with primary hypertension: A randomized controlled trial. *Patient Educ Couns*. 2020;103(2):336-42.
- [29] Marseille BR, Commodore-Mensah Y, Davidson PM, Baker D, D'Aoust R, Baptiste L. Improving hypertension knowledge, medication adherence, and blood pressure control: A feasibility study. *J Clin Nurs*. 2021;30(19-20):2960-67.
- [30] Ranjbar H, Sadeghi-Vazin K, Bakhshi M. The cost-effectiveness of peer education on medication adherence in the elderly with hypertension: A randomized controlled trial. *BMC Public Health*. 2024;24(1):3268.
- [31] Mattei da Silva AT, de Fátima Mantovani M, Castanho Moreira R, Perez Arthur J, Molina de Souza R. Nursing case management for people with hypertension in primary health care: A randomized controlled trial. *Res Nurs Health*. 2020;43(1):68-78.
- [32] Zhang J, Guo L, Mao J, Qi X, Chen L, Huang H, et al. The effects of nursing of Roy adaptation model on the elderly hypertensive: A randomised control study. *Ann Palliat Med*. 2021;10(12):12149-58.
- [33] Yazdanpanah Y, Saleh Moghadam AR, Mazlom SR, Haji Ali Beigloo R, Mohajer S. Effect of an educational program based on health belief model on medication adherence in elderly patients with hypertension. *Evid Based Care*. 2019;9(1):52-62.
- [34] Woodham NS, Taneeapanichskul S, Somrongthong R, Kitsanapun A, Sompakdee B. Effectiveness of a multidisciplinary approach intervention to improve blood pressure control among elderly hypertensive patients in rural Thailand: A quasi-experimental study. *J Multidiscip Healthc*. 2020;13:571-80.
- [35] Parra DI, Guevara SLR, Rojas LZ. "Teaching: Individual" to improve adherence in hypertension and type 2 diabetes. *Br J Community Nurs*. 2021;26(2):84-91.
- [36] Farahani dastjani F, Shamsi M, Khorsandi M, Ranjbaran M, Rezanfar M. Evaluation of the effects of education based on health belief model on medication adherence in diabetic patients. *Iran J Endocrinol Metab*. 2016;18(2):83-89.



[37]

Dalal JJ, Kerkar P, Guha S, Dasbiswas A, Sawhney J, Natarajan S, et al. Therapeutic adherence in hypertensioncurrent evidence and expert opinion from India. Indian Heart J. 2021;73(6):667-73.

[38]

Pinho S, Cruz M, Ferreira F, Ramalho A, Sampaio R. Improving medication adherence in hypertensive patients: A scoping review. Prev Med. 2021;146:106467.

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Nursing, Manikaka Topawala Institute of Nursing, Charusat, Anand, Gujarat, India.

2. Assistant Professor, Department of Nursing, Manikaka Topawala Institute of Nursing, Charusat, Anand, Gujarat, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Divya Jain,  
Vrundawan Residency, Opposite Vinayaka Institute, Vadtal Road, Bakrol,  
Anand, Gujarat, India.  
E-mail: divyajain.nur@charusat.ac.in

PLAGIARISM CHECKING METHODS: [\[Jain H et al.\]](#)

• Plagiarism X-checker: Jul 17, 2025

• Manual Googling: Oct 11, 2025

• iThenticate Software: Oct 13, 2025 (14%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:

• Financial or Other Competing Interests: None

• Was informed consent obtained from the subjects involved in the study? NA

• For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: Jul 16, 2025

Date of Peer Review: Aug 19, 2025

Date of Acceptance: Oct 16, 2025

Date of Publishing: Feb 01, 2026

Journal of Clinical and Diagnostic Research. 2026 Feb, Vol-20(2): LE01-LE05

5