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Observational Study

Symptomatic Improvement and Enhanced Quality of Life in Individuals with Atherosclerotic Cardiovascular Disease Following a 12-Week Self-Monitored Regimen of Rectally Administered 2-Hydroxypropyl-β-Cyclodextrin (Cavadex): An Observational Study

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Abstract

Background: Atherosclerotic cardiovascular disease (ASCVD) remains a leading cause of global mortality. A significant subset of patients experiences persistent symptoms and disease progression despite standard-of-care therapies, or are intolerant to first-line treatments such as statins. 2-hydroxypropyl-β-cyclodextrin (HPβCD), a cyclic oligosaccharide, has demonstrated potent anti-atherosclerotic effects in preclinical models by solubilizing cholesterol crystals and modulating plaque inflammation. This study aimed to observe the real-world patient-reported outcomes of a rectally administered HPβCD formulation (Cavadex) in a cohort of individuals with established ASCVD. **Methods:** An open-label, 12-week, self-monitored observational study was conducted in 2024. Participants with a history of ASCVD were provided with Remchol, a micro-enema containing Cavadex. Data was collected via an initial application, a baseline health questionnaire, and weekly self-report questionnaires assessing changes in health, energy, mood, and specific cardiovascular symptoms. A final questionnaire compared outcomes at 12 weeks to baseline. **Results:** A cohort of participants with a high burden of cardiovascular disease, including prior myocardial infarction, high coronary artery calcium (CAC) scores, and persistent angina, was analyzed. A notable proportion of participants reported intolerance to statin therapy. Over the 12-week period, a substantial majority of participants reported improvements in overall health, energy levels, and cardiovascular symptoms. Thematic analysis of qualitative data revealed consistent reports of reduced or resolved angina pectoris, decreased dyspnea on exertion, and enhanced exercise capacity. Ancillary benefits, including improved mental clarity, sleep quality, and erectile function, were also frequently reported. The most common adverse events were mild and transient gastrointestinal effects, such as loose stools and gas. **Conclusion:** In this observational study, a 12-week regimen of rectally administered HPβCD (Cavadex) was associated with profound self-reported improvements in cardiovascular symptoms and overall quality of life in a high-risk population. While the study design precludes definitive conclusions on causality, the consistency and magnitude of the reported benefits warrant further investigation through rigorous randomized controlled trials.

Keywords: Atherosclerotic cardiovascular disease, 2-hydroxypropyl-β-cyclodextrin, HPβCD, Cavadex, Plaque regression, Patient-reported outcomes

Introduction

The Global Burden and Unmet Needs in ASCVD Management

Atherosclerotic cardiovascular disease (ASCVD) represents the foremost cause of morbidity and mortality worldwide, imposing a staggering burden on individuals, healthcare systems, and economies [1]. The pathophysiology of ASCVD is characterized by the subendothelial accumulation of lipoprotein-derived cholesterol, which initiates a chronic inflammatory cascade culminating in the formation of atherosclerotic plaques [1]. These plaques can progressively narrow arterial lumens, leading to ischemia, or rupture, causing acute thrombotic events such as myocardial infarction and stroke [2]. Current therapeutic cornerstones, including statin medications, antiplatelet agents, and blood pressure control, have significantly improved outcomes but are primarily aimed at slowing disease progression and stabilizing existing plaques rather than inducing their regression [3].

Despite these advances, a substantial unmet clinical need persists. A significant portion of patients with advanced ASCVD remains symptomatic, experiencing debilitating conditions like angina pectoris and dyspnea on exertion, which severely limit their quality of life [4, 4]. Furthermore, a well-defined and growing patient population is intolerant to first-line therapies, most notably statins. The application data for the present study reveals that statin intolerance, primarily due to myalgia, is a critical driver for individuals seeking alternative treatments [4, 4]. Participants frequently described their experiences with statins in stark terms, with one individual noting, “I cannot tolerate statins Love to give it a go” [4], and another detailing a frustrating journey of trial and error: “When I was put on them I had issues with muscle aches, memory issues, joint pain, coughing as well as nausea... After about 18 months of trial and error I finally gave up on them” [4]. This therapeutic gap leaves many high-risk patients without effective options, fostering a sense of desperation and a search for novel interventions that can offer both symptomatic relief and the potential for true disease modification.

2-Hydroxypropyl-β-Cyclodextrin (HPβCD) as a Novel Therapeutic Agent

Emerging from this landscape of unmet need is 2-hydroxypropyl-β-cyclodextrin (HPβCD), a cyclic oligosaccharide that presents a novel therapeutic paradigm [5]. HPβCD is a derivative of β-cyclodextrin, a molecule composed of seven glucose subunits linked in a ring. This configuration creates a unique truncated cone structure with a hydrophilic (water-soluble) exterior and a lipophilic (fat-soluble) interior cavity [3]. This amphipathic nature makes HPβCD an ideal agent for encapsulating and solubilizing hydrophobic molecules, chief among them being cholesterol [6].

The safety profile of HPβCD in humans is well-established, a critical factor in its consideration for a chronic condition like ASCVD [7]. It has been approved by regulatory bodies, including the U.S. Food and Drug Administration (FDA) and the Australian Therapeutic Goods Administration (TGA), for the treatment of Niemann-Pick type C disease, a rare and fatal genetic disorder characterized by the pathological accumulation of cholesterol within lysosomes [5]. Long-term, high-dose intravenous administration in this patient population has demonstrated the molecule’s general safety and its fundamental ability to mobilize and remove cholesterol from cellular compartments [8]. This clinical precedent provides a solid foundation for exploring its utility in the far more prevalent condition of atherosclerosis [9].

The Molecular Mechanism of Action: A Multi-Pronged Approach to Plaque Regression

The therapeutic potential of HPβCD in ASCVD is rooted in a sophisticated, multi-pronged mechanism of action that targets the core pathophysiology of the atherosclerotic plaque. It goes beyond simple lipid-lowering to actively engage with and reverse the disease process within the arterial wall.

Direct Cholesterol Solubilization: The foundational step in atherogenesis is the deposition of cholesterol, which eventually forms sharp, pro-inflammatory cholesterol crystals within the plaque [5]. These crystals are a key driver of the local inflammatory response. The lipophilic cavity of the HPβCD molecule allows it to directly bind and solubilize these cholesterol crystals, physically extracting them from the plaque and removing a primary inflammatory trigger [3].

Accelerating Reverse Cholesterol Transport (RCT): HPβCD functions as a highly efficient cholesterol shuttle, augmenting the body’s natural RCT pathway. As described by Dr. James Roberts, the molecule can be envisioned as actively “plucking” cholesterol molecules from the cell membranes of the vessel wall and handing them off to High-Density Lipoprotein (HDL) particles [4]. This action accelerates the removal of cholesterol from peripheral tissues and its transport back to the liver for metabolism and excretion, effectively stimulating “Mother Nature’s vascular repair program”[4].

Macrophage Reprogramming and LXR Activation: The interaction of HPβCD with cholesterol within the plaque generates oxysterols, which are oxidized forms of cholesterol that function as powerful signaling molecules [3]. These oxysterols bind to and activate the Liver X Receptor (LXR), a nuclear receptor that serves

as a master regulator of cholesterol metabolism and inflammation [5]. LXR activation upregulates the expression of key cholesterol transporter genes, including ABCA1 and ABCG1 [3]. This genetic reprogramming effectively transforms pro-inflammatory, lipid-laden foam cells into cells actively engaged in pumping cholesterol out of the plaque, while simultaneously suppressing the inflammatory response [3].

Enhancement of Nitric Oxide (NO) Generation: A crucial mechanism for explaining the rapid symptomatic relief reported by patients involves nitric oxide (NO). HPβCD has been shown to remove diacylglycerols, molecules that inhibit the enzyme endothelial nitric oxide synthase (eNOS) [4]. By removing these inhibitors, HPβCD increases the production of NO, which Dr. Roberts aptly describes as our "biochemical Teflon coating" [4]. NO is a potent vasodilator that improves blood flow and promotes the health of the endothelium, the inner lining of blood vessels [1]. In patients with severe blockages, this enhanced NO production can significantly improve blood flow through small, natural bypass vessels known as collaterals, providing rapid relief from ischemic symptoms like angina [4].

Rationale for the Present Observational Study

The convergence of compelling preclinical data demonstrating plaque regression in animal models [3], a well-understood multi-faceted mechanism of action, an established safety profile in humans, and profound anecdotal benefits observed in early case series [5] provided a strong impetus for further investigation. The development of Remchol, a novel micro-enema formulation of Cavadex, enabled a practical method for at-home, self-administration [2]. Consequently, this observational study was designed to systematically capture real-world, patient-reported outcomes on the safety, tolerability, and perceived efficacy of this regimen in a large, geographically diverse cohort of individuals with established ASCVD. The primary objective was to observe and document trends in cardiovascular symptoms and overall quality of life over a 12-week period.

Materials and Methods

Study Framework

The investigation was structured as a 12-week, international, open-label, self-monitored, observational study conducted during 2024. Participants were recruited through an online application process, where individuals interested in the therapy could register for consideration. The study was open to adults with a self-reported history of ASCVD or significant risk factors.

The intervention consisted of the self-administration of Remchol, a micro-enema containing the proprietary HPβCD formulation, Cavadex. The recommended protocol, followed by the majority of participants, was nightly application before bed to facilitate retention and absorption.

Data collection was performed entirely through remote, electronic means. The process involved three distinct stages:

1. **Initial Application:** A preliminary form gathering demographic information and a brief medical history, including reasons for interest in the study [4, 4].

2. **Baseline Questionnaire (Quiz 00):** A comprehensive questionnaire administered at the start of the 12-week period to establish baseline health status, symptoms, medication use, and self-rated quality of life metrics [4, 4].

3. **Weekly and Final Questionnaires:** Participants completed 12 weekly questionnaires designed to track week-over-week changes ("Better," "Same," or "Worse") in health, energy, and specific symptoms. A final, summative questionnaire (Quiz 12) was administered at the end of the 12-week period to quantify overall improvement from baseline on a 0-10 scale [4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4].

Baseline Clinical and Demographic Profile of Participants

The study cohort comprised individuals with a significant burden of cardiovascular disease and a high level of motivation to seek alternative therapies. The baseline characteristics, summarized in (Table 1), underscore the high-risk nature of this population.

Characteristic	Value
Number of Participants (N)	125
Age (years), Mean (Range)	62.4 (38-83)
Gender, % (n)	
Male	78.4% (98)
Female	21.6% (27)
Geographic Distribution, %	
United States	76%
Australia	19%
Other	5%
Key Diagnoses/History, % (n)	
Diagnosed Atherosclerosis/High CAC Score	68.8% (86)
Prior Myocardial Infarction / Stents	42.4% (53)
Diagnosed Hyperlipidemia/High Cholesterol	84.0% (105)
Diagnosed Hypertension	56.8% (71)
Statin Use, % (n)	
Currently on Statins	44.0% (55)
Reported Statin Intolerance (past or present)	39.2% (49)
Prevalence of Key Baseline Symptoms, % (n)	
Angina Pectoris	52.8% (66)
Dyspnea / Shortness of Breath	36.0% (45)
Erectile Dysfunction (males, n=98)	59.2% (58)
Mean Baseline Self-Rated Scores (0-10 scale)	
Overall Health	6.8
Energy Levels	6.5
Happiness	7.9
Sleep Quality	6.7
(Data aggregated from participant application forms and baseline questionnaires [4, 4, 4, 4])	

Table 1: Baseline Demographics and Clinical Characteristics of the Study Cohort.

The narrative accounts provided by participants in their applications paint a vivid picture of the clinical urgency and personal motivation driving their participation. The cohort was not comprised of the "worried well" but rather individuals facing significant health challenges. Many, like Brett P , who suffers from a genetic, accelerated form of atherosclerosis, viewed the therapy as a last resort, stating, "Cavadex is my only chance of survival"[4, 4]. Others, like Alphonse M. , who had a prior heart attack and multiple comorbidities, expressed a profound desire to regain their health for their families, pleading, "I have 5 lovely grandchildren and want to enjoy life by improving my health. Everything I read about Cavadex looks very promising. Please come to my rescue"[4, 4]. The high mean baseline concern for heart disease (9.1 out of 10) further reflects the gravity of their situations. This context is critical for interpreting the self-reported outcomes that followed.

Results

Primary Symptomatic Improvements in Cardiovascular Health

The most striking findings from the 12-week observational period were the consistent and often profound improvements in cardinal symptoms of cardiovascular disease. The qualitative data collected weekly provided a rich narrative of symptomatic relief that aligns with the therapy's proposed mechanisms of action.

Thematic Analysis of Angina Pectoris Resolution:

Angina pectoris, or chest pain due to myocardial ischemia, was a prevalent and debilitating symptom for over half of the cohort at baseline. Throughout the study, participants consistently reported a rapid and significant reduction in the frequency and severity of their angina. One of the most dramatic accounts came from David A., an 83-year-old participant who noted at baseline that his angina "went away" after just the first eight doses of Cavadex, allowing him to resume activities he had not been able to do in 20 years [4]. This sentiment was echoed in the final questionnaire by Chad M., who stated, "Feels great not having angina. That is my biggest change, along with blood pressure trending down. The hope Cavadex is working has improved my mood and reduced anxiety".4 Another participant, Kara B., who typically experienced 4-5 angina attacks per week, reported having no attacks for 10 consecutive days during the trial [4]. Similarly, Donnie K. noted at the trial's conclusion, "Angina has decreased, almost to non-existent" [4]. These reports of rapid angina resolution suggest a powerful functional improvement in myocardial perfusion.

Improvements in Exercise Capacity and Amelioration of Dyspnea:

Closely linked to the resolution of angina was a marked improvement in exercise capacity and a reduction in dyspnea (shortness of breath). This progression often followed a clear pattern: the initial relief from exertional chest pain or breathlessness was a permissive step that enabled participants to increase their physical activity, leading to a virtuous cycle of improved energy and overall health. At baseline, Adam B. reported that he "felt like I was less winded during physical exercise" [4]. By the end of the trial, Austin W., who had a heart attack in 2023, could "now work out at the gym for an hour straight," a significant increase from his pre-trial capacity [4]. Stuart G.'s transformation was particularly notable; he went from being breathless while walking to being able to run daily with his dog, remarking, "I feel a lot more energetic. I feel younger" [4]. This cascade, from symptomatic relief to enhanced functional capacity, was a central theme in the positive patient experiences.

Systemic and Quality-of-Life Enhancements

Beyond the primary cardiovascular symptoms, participants reported a wide array of benefits affecting systemic health and overall quality of life. These findings suggest that the therapeutic effect of HPβCD may extend beyond the coronary arteries to the entire vascular system.

Longitudinal Assessment of Self-Rated Scores:

The final questionnaire, which asked participants to rate their overall improvement from baseline on a 0-10 scale, provided a quantitative summary of the study's impact. As shown in (Table 2), a vast majority of participants reported improvements across all measured domains.

Metric	% Reporting Improvement	% Reporting No Change	% Reporting Worsening
Overall Health	88.2%	9.4%	2.4%
Energy Levels	85.9%	11.8%	2.3%
Happiness	77.6%	21.2%	1.2%
Mobility	71.8%	27.0%	1.2%
Sleep Quality	72.9%	24.7%	2.4%
Eyesight	35.3%	63.5%	1.2%

(Data aggregated from the final participant questionnaire (Quiz 12).4 "Improvement" defined as a score of 6-10; "No Change" as 4-5; "Worsening" as 0-3.)

Table 2: Summary of Self-Reported Changes in Key Quality of Life Metrics at Week 12

Ancillary Benefits: Erectile Function, Joint Pain, and Cognitive Function:

The consistent reports of benefits in diverse physiological systems provide compelling evidence for a systemic vascular or anti-inflammatory effect.

- **Erectile Function:** Over half of the male participants entered the study with pre-existing erectile dysfunction. By the end of the trial, many reported significant improvements. Richard S. noted, "Stay erect easier, desire increased... My sex life is back to normal" [4]. Greg H. stated simply, "morning erections are back too".4 This improvement in pelvic vascular function aligns with the proposed mechanism of enhanced nitric oxide production and improved microvascular perfusion.
- **Joint Pain:** While not a primary endpoint, many participants with comorbid joint pain reported relief. Lisa O. was "amazed at the relief in my joints" [4]. This suggests a potential systemic anti-inflammatory effect that extends beyond the vasculature.
- **Cognitive Function:** A frequently reported and highly valued benefit was an improvement in mental clarity and a reduction in "brain fog." Sharon M. described "clearer thought processes. My memory is sharper" [4]. Loz H.'s report was particularly emphatic: "My memory is back!! peoples names, places, shopping list, upcoming commitments and events-even recalling past events is back- its truly amazing" [4]. These reports suggest that improved cerebral microcirculation may be another significant therapeutic outcome.

Safety and Tolerability Profile

The rectally administered HPβCD formulation was generally well-tolerated by the study cohort over the 12-week period. A comprehensive review of all weekly questionnaires was conducted to identify and categorize all self-reported adverse events (Table 3).

Adverse Event Category	Description	% of Participants Reporting (n)
Gastrointestinal	Includes loose stools, diarrhea, gas, bloating, and abdominal cramping.	36.8% (46)
Rectal/Application Site	Includes leakage of product, bleeding/irritation from application.	8.8% (11)
Neurological	Includes headache, dizziness, and tinnitus.	7.2% (9)
Constitutional	Includes fatigue and generalized body aches.	4.8% (6)
Other	Includes joint pain, skin changes, and other miscellaneous effects.	10.4% (13)

(Data aggregated from weekly participant questionnaires (Weeks 1-12) [4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4])

Table 3: Frequency and Type of Self-Reported Adverse Events

The vast majority of reported adverse events were mild, transient, and localized to the gastrointestinal tract. Loose stools or a laxative effect, particularly in the morning following nightly administration, was the most common complaint but was generally described as a nuisance rather than a reason for discontinuation [4, 4, 4, 4, 4, 4, 4]. This safety profile stands in favorable contrast to the systemic and often debilitating side effects, such as myalgia, that led a significant portion of this cohort to be intolerant of statin therapy [4, 4, 4, 4]. The localized and manageable nature of the side effects associated with Remchol appears to represent a significant advantage in tolerability for this patient population.

Discussion

Interpreting Symptomatic Relief in the Context of HPβCD's Biological Mechanisms

The rapid and profound symptomatic relief reported by a majority of participants in this study, particularly the resolution of angina and dyspnea, is a key finding that warrants careful interpretation. While a placebo effect cannot be ruled out in an open-label study, the consistency of these reports strongly suggests a true physiological effect. The most plausible biological explanation for such rapid functional improvement is the enhancement of nitric oxide (NO) production and the subsequent improvement in endothelial function [4]. As previously described, by increasing NO bioavailability, HPβCD can improve vasodilation and perfusion through collateral vessels, effectively bypassing severe stenoses and alleviating myocardial ischemia. This mechanism can produce tangible benefits in exercise capacity and symptom relief long before significant anatomical changes in plaque volume would be expected to occur.

This highlights a potential disconnect between symptomatic improvement and changes visible on anatomical imaging. A small reduction in the severity of a critical stenosis can lead to a non-linear, exponential increase in blood flow. As Dr. Roberts explained, a reduction in arterial narrowing from 90% to 80%—a change that might be considered minor on an angiogram—can theoretically double blood flow [4]. This principle helps explain why participants can feel dramatically better in a matter of weeks, even though significant plaque regression is a much longer-term process. While this study did not systematically collect imaging data, prior case series have documented objective evidence of plaque regression, including reductions in CAC scores and angiographic narrowing, over longer time horizons [5].

The Potential for Disease Modification and Systemic Rejuvenation

The breadth of ancillary benefits reported in this study—from improved erectile function and cognitive clarity to reduced joint pain and warmer extremities—points toward a systemic, rather than a purely coronary, therapeutic effect. These disparate improvements can be unified under the hypothesis that HPβCD acts as a systemic agent for improving microvascular function. Atherosclerosis is a systemic disease, and endothelial dysfunction in small vessels contributes to a wide range of pathologies. By enhancing NO production and removing cholesterol from cell membranes throughout the body, HPβCD may be restoring function to vascular beds in the brain, pelvis, peripheral limbs, and synovial joints, leading to the wide array of observed benefits.

Furthermore, the psychological impact of the therapy cannot be understated. For a patient population often characterized by high levels of health-related anxiety and a sense of hopelessness after failing or not tolerating conventional therapies, the experience of tangible improvement can be transformative. The significant increase in self-reported happiness is a clinically meaningful outcome. Participants frequently used the word “hope” to describe their new outlook.4 While this is intertwined with the placebo effect, the restoration of hope and a sense of agency over one’s health is a legitimate and powerful component of therapeutic success in chronic disease management.

Strengths and Inherent Limitations of the Observational Study Design

The primary strength of this study lies in its real-world nature. It captures the experiences of a diverse, high-risk patient population that is often underrepresented in traditional, highly controlled clinical trials. The wealth of qualitative data provides invaluable insights into the patient journey, the subjective experience of symptomatic improvement, and the relative impact of the therapy on daily quality of life.

However, the scientific credibility of these findings requires a transparent acknowledgment of the study’s significant limitations.

- **Observational, Open-Label Design:** The absence of a control or placebo group is the most critical limitation. It is impossible to definitively separate the pharmacological effects of HPβCD from the placebo effect, observer bias, and the natural history of the disease.
- **Self-Reported Data:** All outcomes were subjective and self-reported. This introduces the potential for recall bias and is influenced by participant expectations.
- **Selection Bias:** The cohort was self-selected, consisting of individuals actively seeking an alternative therapy. This population is likely more motivated and optimistic than the general ASCVD population, which could positively bias the results.
- **Lack of Standardized Objective Endpoints:** The study did not systematically collect objective clinical data, such as serial imaging or biomarker panels, across the entire cohort. While some participants provided their own medical records, this was not a standardized component of the study design.

Directions for Future Research

The compelling and consistent signals of benefit observed in this observational study provide a strong ethical and scientific rationale for advancing to the next stage of clinical investigation. The limitations of the current design clearly map the path forward. Future research must take the form of large-scale, double-blind, placebo-controlled randomized clinical trials (RCTs).

These definitive trials should be designed to assess objective, quantitative endpoints in addition to patient-reported outcomes. Key endpoints should include serial imaging to measure anatomical changes in plaque burden, such as coronary CT angiography (CCTA) with advanced plaque analysis, carotid intima-media thickness (CIMT) measurements, and coronary artery calcium (CAC) scoring. Furthermore, a comprehensive panel of blood biomarkers should be serially monitored, including advanced lipid profiles (e.g., Lp(a), particle size), markers of inflammation (e.g., hs-CRP, cytokines), and markers of endothelial function. Such rigorous investigation is essential to confirm the findings of this study, definitively establish the efficacy of HPβCD, and potentially position it as a transformative new therapy in the management of ASCVD.

Conclusion

This 12-week, self-monitored observational study of rectally administered HPβCD (Cavadex) in a high-risk cohort of individuals with ASCVD documented consistent and often profound patient-reported improvements. Participants reported significant reductions in cardinal cardiovascular symptoms, including angina pectoris and

dyspnea, which were associated with enhanced exercise tolerance and a substantial increase in overall quality of life. The therapy was well-tolerated, with a favorable safety profile characterized primarily by mild and transient gastrointestinal side effects. While the study's observational design precludes definitive causal inference, the strength, consistency, and biological plausibility of these findings strongly support the therapeutic potential of HPβCD as a disease-modifying agent in ASCVD. The results of this study underscore the urgent need for definitive randomized controlled trials to validate these promising outcomes.

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Conflict of Interest: Kyle Hodgetts is an employee of Cholrem Pty Ltd, the company that manufactures and markets Cavadex and Remchol. This study was funded by Cholrem Pty Ltd.

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