Case Report

Use of reverse diet kit as a treatment to regress atheroma in a known CAD patient: A case report

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ABSTRACT

The way people eat have changed rapidly across the globe and is one of the reasons for developing coronary artery disease (CAD). Atheroma is caused due to the accumulation of fatty deposits and scar tissue leading to the degeneration of the walls of the arteries, restriction of the circulation and a risk of thrombosis. This single case experimental study shows that regression in atheroma may be achieved by replacing the normal diet with a low calories diet used in the reverse diet kit. The patient complained of angina on minor exertion. Post admission the patient underwent a computed tomography angiogram (CT-angiogram) to measure the plaque volumes of left anterior descending artery (LAD), left circumflex artery (LXC) and right coronary artery (RCA) of the heart. The patient was monitored for 12 weeks with the administration of reverse diet as a treatment method. The change in weight, blood pressure and heart rate was monitored every week. After 12 weeks, CT-angiogram was performed again. There was a 7.3 kg decrease in weight along with normalization of blood pressure (BP). A 92.8 mm^3 regression of the total atheroma volume was observed. The diet provided may help in reducing atheroma burden in this CAD patient.

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1. Introduction

Change in the type of diet is mostly considered as the primary lifestyle approach for reducing cardiovascular disease (CVD) risk, with a focus on reducing the intake of saturated fatty acids in order to reduce low density lipids (LDL) and cholesterol levels [1]. The compounds present in food have an influence on the human health. Due to this complex relationship between diet and health it is important to develop strategies that delay or prevent chronic diseases such as CAD [2].

CAD can lead to myocardial infarction (MI). This risk may be reduced by controlling consumption of nicotine, alcohol, drugs, fats, cholesterol and salt. Weekly monitoring of blood pressure, performing daily exercise and loosing body weight is also beneficial [3]. Diagnosis of coronary artery disease is increasingly being carried out using Coronary CT angiography owing to its improved spatial and temporal resolution of the images [4].

This case study helps to present the possible relationship between low calorie diet and atheroma regression in CAD patients.

2. Patient information

Mr. AL, aged 62 years, complained of left side chest pain radiating to left hand as well as the left side of the face while walking within 5 minutes. He suffered from MI in December 2020. The patient was diagnosed with multiple vessel coronary artery disease and was suggested coronary angiography (CAG).

3. Clinical findings

On presentation to the clinic, the patient weighed 62 kg with a body mass index (BMI) of 26.9 kg/m^2. His systolic blood pressure (SBP) was 137 mm/hg, diastolic blood pressure (DBP) was 96 mm/hg and heart rate was 64 pulse/min. Blood glucose level was at 105 mg/dL and serum creatinine was 1.4 mg%.

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4. Timeline

The patient suffered from MI in December 2020. Post recovery he was diagnosed with triple vessel coronary artery disease and has a PTCA in RCA. In February 2021 he visited the clinic with symptoms of Angina. He was prescribed reverse diet kit therapy for a period of 12 weeks. He showed maximum compliance towards the diet therapy. The diagnostics assessments showed improvement, the details of which are discussed below.

5. Diagnostic assessment

Characterization and quantification of atherosclerotic plaque as calcified fibrotic and lipid core was done with help of 128 slice CCTA (cardiac CT angiography) keeping resting HR below 70/min and breath hold for 15 seconds. Non-ionic contrast was given during procedure [5].

The following parameters were assessed during the entire intervention:

- Change in weight
- Change in blood pressure
- Change in heart rate
- Change in blood sugar level
- Lipid profile test
- Change and % change in calcium volume
- Change and % change in lumen volume
- Plaque to lumen ratio
- Change in total atheroma volume

6. Therapeutic intervention

After obtaining a written consent, the patient was prescribed an intervention of the reverse diet kit for a period of 12 weeks as part of the treatment. The patient was advised to incorporate daily walk, yoga and low impact aerobic exercises. The patient was asked to update his blood pressure before and after the walk. The weight and heart rate had been recorded daily long with the diet update.

The Reverse diet kit is a scientifically designed diet box containing pre-portioned food products that fulfill the daily requirement of breakfast, lunch, dinner, soup and early morning diet options (Table 1, only fresh vegetables are required to be added separately).

Table 2 describes in detail the ingredients used to make the reverse diet kit and their expected role.

The diet is anti-inflammatory with a high anti-oxidant capacity which helps in reversal of CAD progression, improves vessel health, reduces plaque and improves blood flow. The diet contains low glycemic index carbohydrates, low contents of simple sugar and plant based food that helps in weight loss, reduction of inflammation, reduction of triglycerides and high density lipoproteins and thus improves vessel health. Omega 3 fatty acids reduce production of inflammatory products and hinders the process of inflammation. Vitamin A and vitamin C have excellent antioxidant capacity which kill generated toxic products such as pro-inflammatory products and free radicals. Also, vitamin C reduces vessel damage by providing adequate collagen synthesis and improves immunity.

Reverse diet kit has high Oxidative Radical Absorption Capacity (ORAC) unit i.e. 64,000 per day. Reverse diet kit food will keep

Table 1
Nutrition content of daily reverse diet and monthly diet plan of the patient.

Nutrition factor							Content
Calories							1000 kcal
Carbohydrates (Low insulin provoking and low glycemic index carbohydrates)							40% of total calories
Proteins (Moderate protein)							20% of total calories
Fats							40% of total calories
Vitamin C							1 g per day
Vitamin E							Fortified
Potassium							4700 mg
Omega 3 fatty acid							Quantity sufficient
Low sodium							Quantity sufficient
Garlic							Quantity sufficient
Ginger							Quantity sufficient

Time/Menu	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Early morning	1 tsp of Madhavprash daily						
	Boiled egg whites daily						
Breakfast 8:00 am	1 cup cardiac tea daily						
	Muthiya mix (5−6 small Steam Balls)	Soy dhokla mix (3−4 Medium pcs)	2 small Rajma Flour Dosa	Soy dhokla mix (3−4 Medium pcs)	Muthiya mix (5−6 small Steam Balls)	Soy dhokla mix (3−4 Medium pcs)	2 small Rajma Flour Dosa
	2 tsp green chutney daily						
Mid-morning 11 am	1 medium fruit daily						
Lunch 1.00 pm	1 bowl salad + pc of lemon daily						
	2 small fulka daily						
	1 bowl vegetable daily						
	1 bowl lentil dal daily						
	Grilled or steam						
	3−4 small pc chicken/fish						
	With lunch and dinner 1 tsp of chutney						
Mid-evening 4.30 pm	1 cup cardiac tea daily						
	1 cup nut mix chiwda + 1 tsp Madhavprash daily						
Evening 6.30 pm	1 bowl tamarind soup daily						
Dinner 8 pm	1 bowl salad + pc of lemon daily						
	2 small fulka daily						
	1 bowl vegetable daily						
	1 bowl lentil dal daily						

Tsp: Tea spoon.

Table 2
Detailed information of key ingredients of reverse diet kit.

Sr no	Ingredient	Quantity	Nutritional value	per 100 g	Expected role
1	**Lentil Dal**				
	Product	Percentage	Energy	233 kcal	High in protein low in carbohydrate
	Tur Dal	50	Protein	16 g	so it is having low insulin index
	Masur Dal	50	CHO	4 g	hence it red
			Fat	1 g	
2	**Atta**				
	Product	Percentage	Energy	233 kcal	High in fiber and low in
	Red rice	30	CHO	50 g	carbohydrate so it provides proper
	Soyabean	20	Fiber	15 g	satiety with low calories. Herbs
	Hulga	25	Protein	14 g	included can improve metabolism
	Bran	10	Fat	7.2 g	
	Rajgira	10	Potassium	609 g	
	Vidarikand	1.5	Sodium	50 g	
	Safed musali	1.5			
	Shatawari	1			
	Trifala	1			
3	**Rajma Dosa**				
	Product	Percentage	Energy	262 kcal	Easily digestible, high in protein
	Red rice	15	Carbohydrate mg	40 mg	low in carbohydrate high in fiber so
	Udid dal	25	Protein mg	18 mg	it can reduce process of
	Rajma	20	Dietary fiber mg	18 mg	atherosclerosis
	Soyabean	10	Fat mg	7.5 mg	
	Bran	13	Potassium mg	954 mg	
	Oats	15	Sodium mg	13.5 mg	
	Dry ginger powder	2			
4	**Muthiya mix**				
	Product	Percentage	Energy	295 kcal	Low Glycemic index, high in fiber
	Red rice	25	Carbohydrates	28 mg	and herbs to boost up fat
	Jowari	15	Fiber	20 mg	metabolism
	Green gram	25	Protein	15 mg	
	Masur dal	15	Fat	1.25 mg	
	Bran	10	Potassium	409 mg	
	Cumin seeds	2	Sodium	50 mg	
	Fenugreek seeds	3			
	Ashwagandha	1.5			
	Trifala	1.5			
	Salt	2			
5	**Chutney**				
	Product	Percentage	Energy	318 kcal	Taste maker and can boost up fat
	Sesame seeds	85	CHO	13 mg	metabolism
	Moringa powder	6	Protein	4 mg	
	Garlic powder	3	Fat	32 mg	
	Red chilli powder	3	Fiber	12.3 mg	
	Salt	2	Potassium	327 mg	
	Turmeric	1	Sodium	10.3 mg	
6	**Masala**				
	Product	Percentage	Energy	211 kcal	Taste maker and can boost up fat
	Coriander seeds	35	CHO	55 mg	metabolism
	Cumin seeds	35	Fiber	28 mg	
	Garlic powder	6	Protein	6.18 mg	
	Dry ginger powder	6	Fat	4.4 mg	
	Cinnamon powder	6	Potassium	668 mg	
	Black pepper powder	6	Sodium	53 mg	
	Neem powder	2			
	Moringa	2			
	Salt	2			
7	**Nut mix**				
	Product	Percentage	Energy	293 kcal	High fat low carbohydrate provides
	Pumpkin seeds	11	Carbohydrate	13 mg	good satiety and reduces extra
	Sesame seeds	11	Protein	15 mg	calories intake.
	Flax seeds	11	Fat	18 mg	
	Sunflower seeds	11	Fiber	10 mg	
	Puffed Amaranthus	6	Omega 3 fatty acids	2186 mg	
	Sugar substitute	50			
8	**Soya Dhokla**				
	Product	Percentage	Energy	275 kcal	High in protein low in
	Chickpea	40	Carbohydrates	32 g	Carbohydrates with natural
	Soyabean	10	Fiber	18 g	antioxidant can be helpful to keep
	Udid dal	15	Protein	20 g	low Insulin secretion to reduce
	Indian Gooseberry	5	Fat	12.5 g	process of atherosclerosis
	Oats	10	Potassium	991 mg	
	Bran	20	Sodium	10 mg	

Table 2 (*continued*)

Sr no	Ingredient	Quantity	Nutritional value	per 100 g	Expected role
9	**Madhavprash**				This powerful antioxidant agent. It improves endothelial function, prevents from oxidative damage, promotes reverse cholesterol transport from athermanous plaque. It is immune modulator and reduces frequencies of minor illness and allergies.
		Percentage			
	Emblica officinalis (amla)	20			
	Zingiber officinalis (shunthi)	1			
	Piper nigrum (marich)	1			
	Piper longum (Pipalimool)	1			
	Piper longum (Pipali)	1			
	Bambusa arundinasea (Vanshalochan)	0.5			
	Cinnamomum Zeylanicum (twek)	0.5			
	Elettaria cardamomum (Ela)	0.5			
	Cinnamomum tamala (Patra)	0.5			
	Myristica fragrans (Javitri)	0.5			
	Syzygium aromaticum (Lavang)	0.5			
	Aegle marmelos (bliva)	6			
	Clerodendrum phlomidis (Agnimantha)	0.58			
	Oroxylum indicum (shyonk)	0.58			
	Gmelina arborea (Kashmiri)	0.58			
	Stereospermum suaveolens (patla)	0.58			
	Sida coedifolia (bala)	0.58			
	Desmodium gangeticum (shalpranti)	0.58			
	Uraria picta (Prushniparni)	0.58			
	Vigna trilobala (Mudgaparni)	0.58			
	Teramnus labialis (Mashaparni)	0.58			
	Tribulus terrestris (pipli)	0.58			
	Solanum Indicum (chandana)	0.58			
	Solanum xanthocarpum (Utapla)	0.58			
	Pistacia integerrima (vidarI)	0.58			
	Phyllanthus fratenus (Tamalaki)	0.58			
	Vitis vinifera (Draksha)	0.58			
	Leptadenia reticulata (Jivanti)	0.58			
	Inula racemosa (Puskara)	0.58			
	Aquitaria agallocha (Agaru)	0.58			
	Terminalia chebula (Abhya)	0.58			
	Tinospora cordifolia (Guduchi)	0.58			
	Hedychium spicatum (shati)	0.58			
	Cyperus rotundus (Nagarmotha)	0.58			
	Elettaria cardamomum (Punarnava)	0.58			
	Santalum album (Ela)	0.58			
	Nymphaea stellata (Chandana)	0.58			
	Pueraria tuberosa (utapla)	0.58			
	Adhatoda vasica (vidari)	0.58			
	Lilium polyphyllum (vakasha)	0.58			
	Withania somnifera (ashwagandha)	1			
	Asparagus racemosu (shatavari)	1			

antioxidant system of the body switched on for 24 by 7. This will help to reduce endothelial dysfunction and cessation of atherosclerotic plaque progression. Daily intake of 1000 kcal diet will create calorie deficit. Ultimately to meet normal requirement of 1500 kcal/day, body fats will be utilized resulting in reduction in visceral obesity.

7. Follow up and outcomes

The results observed after a 12 week diet plan is as follows:

- Reduction in weight by 7.3 kg was observed. (Almost 12% reduction in weight was observed) and 12.92% reduction in BMI.
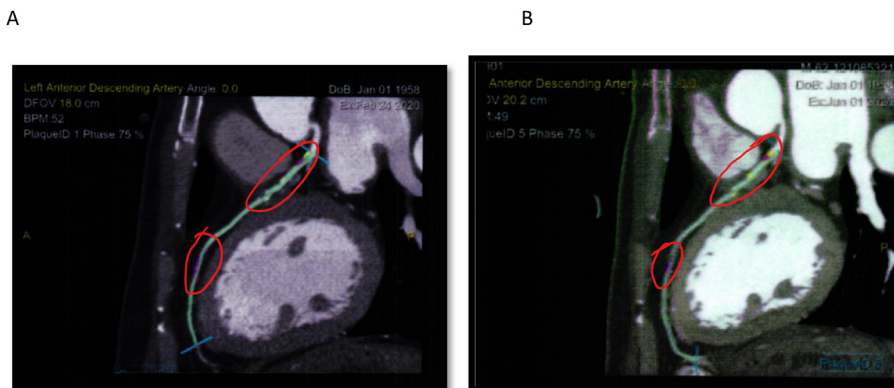

Fig. 1. Cardiac CT angiography results pre and post treatment. A. Prior to treatment, CCTA of LAD showed Calcified plaque of 25.3 mm^3 at proximal, Fibrotic plaque of 111.7 mm^3 at mid and proximal LAD, lipid core of 23.2 mm^3. B. Post treatment length of same LAD was reassessed, Calcified plaque 63.5 mm^3, fibrotic plaque 77.4 mm^3, and lipid core of 15.2 mm^3.

Table 3
Comparison of the lipid profile test done before and after the treatment.

Sr. No	Lipid profile test	Baseline	After 12 weeks
1.	Total cholesterol (mg/dL)	172	110.2
2.	Triglycerides (mg/dL)	130	86.6
3.	HDL (mg/dL)	31.8	38.9
4.	LDL (mg/dL)	122.6	53.98

HDL, High density lipoprotein; LDL, low density lipoprotein.

- Reduction in blood pressure was observed: SBP reduced by 12 mm/hg and DBP reduced by 10 mm/hg.
- From the baseline the change in heart rate was observed at −5 pulse/min.
- Blood sugar reduced from 105 mg/dL to 68 mg/dL.
- The overall change in calcium volume was 23.2% as compared to baseline value 15.6% (Fig. 1).
- Changes in the lipid profile is shown in Table 3.
- The change in the individual artery and total atheroma volume from baseline to post-intervention is depicted in Table 4.
- Almost 100% reduction in prescribed medicines was achieved.

8. Discussion

This case study evaluated the effect of a reverse diet kit on change in weight of patient and plaque calcium volume. Weight reduction of almost 12% was observed along with a considerable decrease in total atheroma by almost 52%.

Obesity has been a significant cause of health problems all over the world with various studies demonstrating a relationship with cardiovascular diseases [6].

Obesity leads to an increase in the metabolic burden of the body as there is requirement for additional thermoregulation, synthetic, trophic, immunological, antitoxic functions and excretion of metabolic products from the tissue [7].

In obesity, an inflammatory process is activated due to free fatty acids, lipids, and oxidized LDL particles leading to atherosclerosis or diseased state. Inflammation causes early endothelial dysfunction and formation of atherosclerotic plaques and it is also related to obesity and type 2 diabetes [6].

The reverse diet kit helped to reduce the LDL by 50% of its baseline value. The intervention also showed an increase in the HDL levels by 7%. HDL facilitates the efflux of cholesterol from the peripheral to liver cells, where it is metabolized. This action prevents the risk of cardiovascular diseases and major coronary events [8]. The intervention of the reverse diet kit lead to the reduction of cholesterol by almost 62% in the patient.

There was an increase in the total calcium volume in the LAD, LCX and RCA by 7.6%. Coronary artery disease and cardiovascular events can be predicted using coronary artery calcium score (CACS), which is a measurement of subclinical coronary atherosclerosis [9]. Plaque regression leads to an increase in calcium volume [10].

The reverse diet kit administered during the treatment is high in fiber, low in carbohydrates, rich in antioxidant, high in proteins and good quality fat that trigger defense mechanism against pro-

Table 4
Comparison of this change in total atheroma volume and the change in individual artery from baseline to latest after reverse diet kit treatment.

Sr. No	Artery	Before	After	Change
1.	Left anterior descending artery (LAD)	117.7	77.4	40.3
2.	Left circumflex artery (LCX)	24.8	0.0	24.8
3.	Right coronary artery (RCA)	43.1	9.4	33.7
4.	Total atheroma volume (mm^3)	179.6	86.8	92.8

inflammatory products, inflammation and reversal of progressing disease. It also leads to increased blood flow as well as reduces plaque formation.

During plaque regression, M2 macrophages help in healing the plaque inflammation by facilitating macroscopic calcium deposits by the process of macrocalcification, through the induction of osteoblastic differentiation and maturation of vascular smooth muscle cells (VSMCs) [10]. This lead to a decrease in the lumen volume from 239.4% to 147.8% thus increasing the plaque to lumen ratio in the RCA by 20. After 12 weeks of intervention, the total atheroma volume reduced by 92.8 mm^3.

Atherosclerotic vascular disease is characterized by plaque development and rupture. Prevention of atherosclerotic vascular disease is important despite the current developments in therapeutics [11]. Risk modification therapies like lipid-lowering helps in prevention of atherosclerosis and has been a hypothetical goal since the early 1900s. Regression of plaques has been primary aim of research related to atherosclerosis. Several experimental animal studies demonstrate with a change in diet from a high-cholesterol to a low-cholesterol may lead to plaque regression as shown by reduced plaque area [12,13].

We hereby acknowledge that the ability of body to react to certain diet and/or exercise differ with age, geographical and other factors. Also, in the present case the participant has reacted in a beneficial way to the reverse diet but there are other factors such as exercise (like yoga or walk) that may have contributed to the positive effect.

9. Conclusion

The reverse diet kit would have helped the body to use the stored glycogen in the adipose tissues by maintaining the negative calorie balance. Additionally, high antioxidant components of the calorie controlled diet may have led to the reversal of cholesterol transport as reflected by the reduction of the total atheroma volume.

Patient perspective

Patient reported improved quality of life as CAD related symptoms reduced and he was able to perform all his daily activity without any limitations.

Informed consent

The authors certify that they have obtained patient consent form, where the patient has given his consent for reporting the case. The patient understands that efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest

None.

Author contribution

Rohit Sane: Conceptualization, Methodology, Writing-Reviewing. Rahul Mandole.: Visualization, Investigation, Writing-Reviewing and Editing. Gurudatta Amin: Supervision, Data management, Writing- Reviewing.

Acknowledgment

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