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Efficacy of Magnetic Resonance Imaging in assessing the Prognosis of Atherosclerotic plaques in patients under Statin Therapy: A Systematic Review of the Last Decade

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ABSTRACT

The current study aims to conduct a systematic review on the efficacy of Magnetic Resonance Imaging (MRI) in assessing the Prognosis of Atherosclerotic plaques in patients under Statin Therapy. For this purpose, the existing studies focusing on these criteria and the clinical trials and studies have been focused upon. The time frame set for the evaluation of the present literature and findings has been set at the previous decade i.e. the studies of the previous 10 years have been searches through authentic databases and the data related to the current topic has been extracted through efficient sources and reviewers. All the details about MRI efficacy in the assessment of prognosis of Atherosclerotic plaques were reviewed and evaluated in the systematic review and then the findings were reported in order to check the status of research on this topic. A total of 300 studies were initially sampled from which only 65 were considered to be relevant. These studies were then enrolled in current systematic review. The evaluation shows that there is a lack of theoretical basis and harmony of researchers about the efficacy of MRI in the assessment of Prognosis of Atherosclerotic Plaques. The current study has significant research implications in theoretical as well as practical terms and future researchers are directed to enhance the theoretical basis of this topic

Keywords: MRI, Statin Therapy, Atherosclerotic plaques, Systematic Review.

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INTRODUCTION

Atherosclerosis, the main source of cardiovascular (CV) - related mortalities overall, is a disease procedure that is started, kept up and destabilized by an irregular commitment of a few cells and sub-atomic pathways of the inflammation course (Sakakura et.al, 2013). Presentation to raised plasma low-density lipoprotein (LDL) cholesterol levels, either within the sight of or without extra CV hazard factors, starts and drives dynamic lipid and provocative cell penetration in the blood vessel divider, which may result in atherosclerotic plaque complexities (e.g., disintegration, break, and so on.), ischemia-related organ damage and passing. Atherosclerosis is generally a quiet disease and examination thinks about uncovered that it is now present in youth. Due to its quiet improvement, its first sign is often an unexpected and unheralded occasion [1-4]. This actuated researchers and doctors to build up various calculations to evaluate the danger of occasions and invigorated advancement of a substantial exhibit of biomarkers and imaging modalities to survey the nearness of atherosclerosis and its movement. The soonest endeavors at estimating atherosclerosis movement were cultivated with intrusive coronary angiography[5]. A few examinations showed a ground-breaking decrease in occasion rates with even insignificant relapse of luminal narrowing with different medications. Non-intrusive imaging modalities were then tried to quantify the change in atherosclerotic plaque weight or synthesis and turned out to be quickly well known as a way to test medicate viability. Like some other biomarker, an imaging marker needs to meet methodological and administrative prerequisites to give satisfactory result parameters (Libby, P, 2012).

Because of the perceived character of the LDL cholesterol (LDL-C) in starting and advancing atherosclerosis, trailed by arterial wall inflammation, the anti-inflammatory impact of statins, as the most broadly recommended class of decreasing cholesterol medications, has been to a great extent investigated. Among plenty of recorded pleiotropic activities, there is amassing proof demonstrating that statin treatment lessens irritation in vitro, in trial and clinical investigations, however, it is still discussed whether it might rely upon either cholesterol-bringing down or pleiotropic[6]. Despite the systems hidden the anti-inflammatory of statins, a few flowing biomarkers of irritation and intense stage reactants are down directed by statin treatment. In spite of poor-quality foundational irritation being much of the time related with atherosclerosis, association with serum is at times opposing,

potentially recommending that plasma biomarkers may not precisely mirror the level of blood vessel divider aggravation. Consequently, analytic apparatuses that are all the more straightforwardly intelligent of blood vessel irritation have been looked for [7]. The advantages of statins on cardiovascular infections have been obviously settled in a few clinical preliminaries for essential and auxiliary counteractive action. Statin organization diminished LDL cholesterol by 30% to 40% and mortality diminished by 25% to 30%. The instruments of activity in charge of these clinical advantages are not plainly comprehended [8].

Demonstration of plaque composition from the postmortem evidence, as opposed to the level of stenosis, is a key factor for plaque helplessness. Interruption or disintegration of atherosclerotic plaques has been related to the intense beginning of cardiovascular occasions. These examinations described the sores progressively inclined to disturbance (helpless) as lipid-rich and modestly stenosis. These lipid-rich plaques are very thrombogenic on interruption. Angiographic preliminaries intended to explore the impact of lipid-bringing down on atherosclerosis showed a relationship between the hindered movement of coronary narrowing and cardiovascular occasion decrease, recommending that statin treatment may cause relapse and additional adjustment of lipid-rich sores.

High-goals MRI is an innovative, minimally invasive, and innocuous system that permits sequential perception of atherosclerotic plaques. Its convenience for in vivo appraisal and portrayal of atherosclerotic injuries was recently approved utilizing creature models of atherosclerosis and in humans [9]. Furthermore, MRI allows profoundly precise in vivo estimation of corridor divider measurements in human atherosclerotic coronary, aortic and carotid sores. Intrusive and non-obtrusive imaging has been utilized widely to think about the movement of atherosclerosis [10]. A couple of urgent standards administer consecutive imaging of the survey of atherosclerosis to decipher the changes. The high reformation of plaque imaging exhibited by attractive reverberation imaging (MRI) condensed this method, it is one of the highest developed and solid minimally intrusive devices to lead imaging of atherosclerosis. Its low sweep to-examine inconstancy enables agents to use fewer subjects to show the adequacy of intercessions on the piece and size of the [11]. These attributes of high-goals MRI imaging are especially attractive when look into is centered on unthinking plaque investigations of inventive mixes in patients with uncommon maladies who are hard to find and take a crack at clinical preliminaries.

Atherosclerosis has been recognized as a multi-factorial disease. Its presence or development has been described as the progress of the inflammation in the vessel wall and the loss of biochemical and physical interaction amongst the muscle cells and the endothelial cells. A plethora of studies has pointed towards the presence of a molecular link between the myoendothelial communication and the inflammation that develops due to a gap junction. Much of the studies have shown that the prevalence of such structures is essential for the development and progression of the atherosclerotic vessel phenotype. Most of the previous research studies have been focusing upon the explanation of the development of the Atherosclerosis, where others focus on the statin therapy, some individually focus on the effectiveness of the MRI technique in the detection of the condition [12-17].

The present study is being carried out in order to evaluate the efficacy of the system, technique, prognosis used for the detection of the atherosclerosis plaques in patients under statin therapy. For this purpose the researcher is carrying out a systematic review which will be focusing upon the following objectives; to conduct a systemic review on the efficacy of magnetic resonance imagining in assessing the prognosis of atherosclerosis plaques in patients under statin therapy, report the findings from the various studies carried out on the efficacy of magnetic resonance imagining in assessing the prognosis of atherosclerosis plaques in patients under statin therapy and evaluating how magnetic resonance imaging ineffective than other techniques used in assessing the prognosis of atherosclerosis plaques in patients under statin therapy.

The present study will therefore provide a recap of all the major findings and techniques covered by the existing literature on this domain and will also highlight the potential gaps. Thus, the present study can be used by academicians and practitioners to improve their knowledge on the atherosclerosis plaques in patients under statin therapy.

The rest of the article is summarized as follows; a methodology detailing the selection and exclusion of the studies, a review section discussing the major literature on the various domains of the atherosclerosis plaques in patients under statin therapy, a findings section that focuses on the patient demographics and results found in the covered literature and a discussion and conclusion section to present the gaps and a summary of the study.

METHODOLOGY

Selection Process

In this study, strategies for searching the data needed for systematic review were developed by taking into consideration the process of systematic review The approaches needed for this analysis were decided through which the past studies related to the efficacy of MRI in the assessment of prognosis of Atherosclerosis plaques were reviewed in order to complete the objectives of the study. First, it was evaluated that which databases are appropriate for searching out the data for systematic review in the form of existing studies and clinical trials, present on the topic of selection. The studies to be included and the appropriate time frame to be focused were finalized. The databases used to collect data were very authentic and have been mentioned in this study. Different keywords were used to search for the articles and clinical trials. The relevant studies i.e. the studies that matched with the selected keywords were extracted from the databases. The primary objective of the present study was to evaluate the body of research existing upon the efficacy of MRI in an assessment of prognosis of Atherosclerosis plaques, thus the databases that have been appointed and are commonly used in medical research and publish journals relating to the medical fields were selected and articles were drawn from those databases related to current topic. The databases used for the present study include "PubMed, Cochrane Library, Elsevier, Wiley Online Library and Embase". These databases were searched by using keywords of MRI, prognosis of Atherosclerosis, plaques and parameters of MRI in prognosis of

Atherosclerosis plaques and articles on assessment of efficacy of these parameters in prognosis of Atherosclerosis plaques were reviewed thoroughly. The reference list found through this search on databases was critically reviewed and analysed. While searching for related data, there was no distinction of demographics were made based on language or country. Only the studies on evaluation of the efficacy of MRI in the assessment of prognosis of Atherosclerosis plaques were reviewed.

After searching for data and downloading related articles from databases, the inclusion and exclusion criteria was decided. The studies were shortlisted based on their relevancy to the topic.

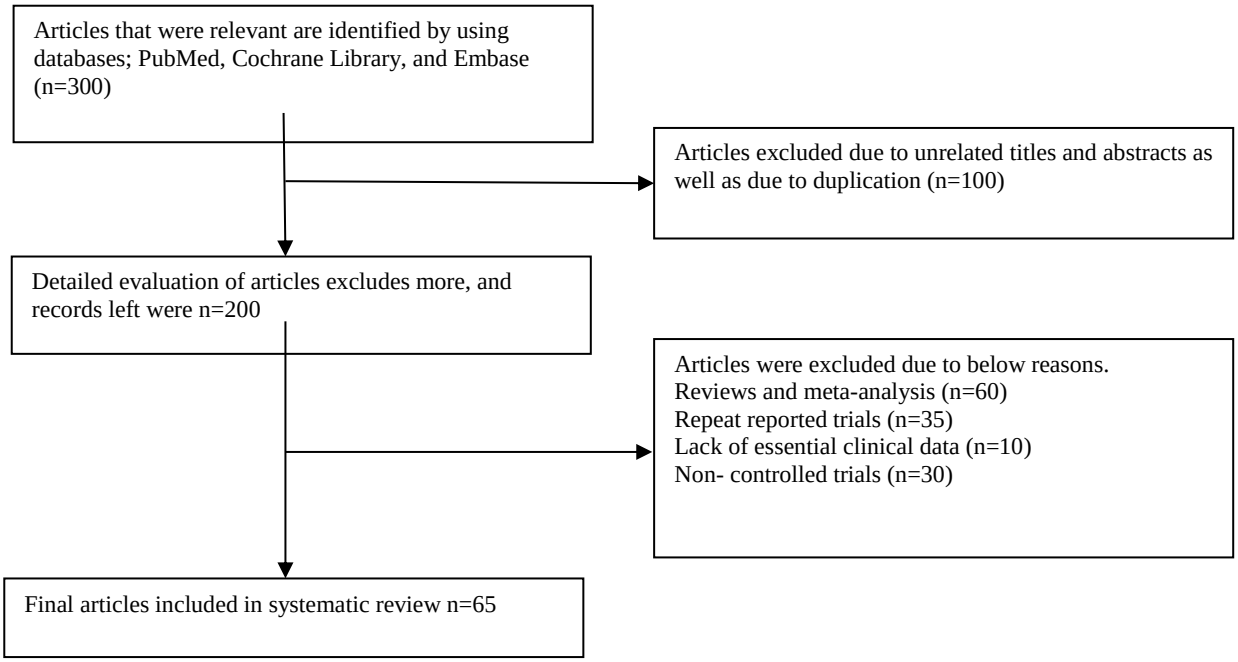


Figure 1: Inclusion criteria

Since the current study aimed to perform a systematic review of the efficacy of MRI in assessment of prognosis of Atherosclerosis plaques of patients under statin therapy so, the studies with these patients were selected only. First of all, articles were selected based on the comprehensive facts reported by authors about clinical outcomes of early and secondary processes. The, the articles were screened out based on mean recorded time period which was selected to be more than three months. The thirst criteria were decided that included studies must have a sample size more than 20. The exclusion criteria were also decided according to which the cases, reports, letters, replies, reviews were excluded and the studies with patients not under statin therapy were also excluded from study. The titles and abstract of all selected articles were reviewed and scanned independently in order to select final studies according to inclusion and exclusion criteria. Thus, the final articles were extracted in which 65 articles were selected according to decided criteria that were reviewed for systematic review. The data about patients, their age, study design, imaging modality, MRI scanner values, imaging biomarkers and statin used was extracted. The studies with parameters of plaque thickness, lumen area, wall area, normalized wall index, total vessel area, lipid core area and cerebral artery were preferred in this regard. After the selection of articles and extraction of data, the statistical analysis was performed to accomplish the purpose of current study. The findings and approaches of selected studies were keenly observed and reviewed in order to record the findings by the study. The overall inclusion and exclusion criteria have been summarized in the figure 1.

After selection of studies, the baseline characteristics of studies were evaluated as given in table 1. The total number of patients that were involved in, found through various reported studies were 650 and all they were included in Atherosclerotic group. All articles were mentioned with some specifications in which authors name, country, patients, MRI scanner, imaging modality, imaging biomarkers, and statin used were included. All these detailed values related to Atherosclerotic group are provided in table 1 in which all the demographic and related data has been given along with. The statistical results found through systematic review has been provided in table 2 and their status has been presented in figure 1.

Systemic review

Atherosclerosis plaque prognosis

Atherosclerosis is identified as the illness of the walls of the arteries that happens to be in the fictile regions of the course of the supply arteries. The process is initiated through the maintenance if the lipids, alteration and oxidation, which provoke the aggravation which causes the stenosis and thrombosis. The injuries caused through the atherosclerosis causes stenosis with possibly the lethal distal ischemia or can activate thrombotic impairment of momentous instrumentalist arteries to the brain, legs, heart and other

organs [4, 18-20]. The sores are found to be present in the inner covering of the veins—the intima—and they have been found to dynamically stimulate the arteries which is inclusive of the media and the adventitia. This condition has been prevalent in the human body for a long time, it has been primarily characterized as an infection. Probably the earliest incidence of the condition was found to manifest in the Egyptian mummies. The incidence in the mummies confirmed the corresponding pathologic highlights that are seen in present day times. Some of the hazardous features of the disease that have been associated with the strengthening and incitation of atherosclerosis, through an impact on the LDL particles and have also been incident with irritation. These risk features most every now and again integrate hypertension, smoking of tobacco, obesity, diabetes mellitus, and hereditary inclination; the atomic subtleties of how they work are not yet known [11, 21-23].Atherosclerosis grows dynamically through persistent advancement of arterial wall sores focused on the gathering of cholesterol-rich lipids and the going with incendiary reaction. These progressions have been portrayed in the histopathology of human plaques and the plaques of exploratory creatures (S Antonopoulos et.al, 2012). These efficiently watched changes are firmly comparable in the coronary conduits, the carotid courses, and the aorta, and they structure a solid depiction of the complete aggregate advancement of atherosclerosis. Characteristic variety in the rate and degree of advancement causes stamped heterogeneity in plaque histology inside individual plaques, among neighboring plaques, among various supply routes known as arteries, and among individual patients.

Cardiovascular maladies are essential reasons for mortality in moderately aged and more individuals around the world. Coronary illness (CHD) is the most widely recognized CV ailment, and atherosclerosis is viewed as its most critical reason. Epidemiological, clinical, and exploratory proof proposes that high serum cholesterol is related to atherosclerosis [24, 25].Several substantial randomized controlled investigations of statins (sedates that hinder 3-hydroxy-3-methylglutaryl-coenzyme An or HMG-CoA) have shown an unmistakable decrease in the occurrence of coronary occasions, in patients either with or without past CHD. Since atherosclerosis advances over the decades, mediation preliminaries require long haul development and an expansive number of members. To survey modifiers of atherosclerotic sickness movement, for example, statins or way of life, surrogate markers are regularly expected to research determinants of atherosclerosis [26-28]. Approved surrogate markers empower the appraisal of promising new medications in a generally brief timeframe, in this way staying away from the need to anticipate the result of preliminaries driven by clinical occasions. On the off chance that progressively delicate and increasingly explicit outcomes are procured, the surrogate markers ought to be anything but difficult to assess, ideally by non-obtrusive methods. There is thusly much current enthusiasm for the non-obtrusive assessment of atherosclerosis.

A study focused upon the local atherosclerotic plaques and investigated whether or not they are sources or indicators of adverse cardiovascular events. The study by de Kleijn, Moll [29] found that atherosclerotic cardiovascular diseases are an imminent burden to the health of a patient. As atherosclerosis has been considered as a systematic disease, the study hypothesized that even a single atherosclerosis plaque consists of plenty of molecular information which is ambivalent in predicting the future cardiovascular issues in all of the vascular regions of a patient. It was found that the plaque osteopontin levels present in a sole lesion were predictive for the future cardiovascular events in the other vascular regions of the body. The local atherosclerosis plaques have been associated as a biomarker which has a high predictive and developmental rate for the future development of the atherosclerosis disease [30, 31].

Imaging techniques of atherosclerosis

The appraisal of atherosclerotic plaque trouble by non-obtrusive imaging methods ought to take into account early discovery of the malady and in vivo distinguishing proof of high-chance plaques. A few obtrusive and non-intrusive imaging procedures are accessible with which atherosclerotic infection can be evaluated [32, 33]. The angiogram, utilizing X-beam innovation as does CT, or MR, all give great spatial goals permitting to recognize the nearness of stenosis, the level of luminal narrowing, as well as data of the luminal surface of projecting atherothrombotic sickness. Use of non-intrusive angiography methods, with intravenous infusion of a differentiation operator, has turned into a routine clinical practice at many focuses to diagram the level of stenosis of the carotid, renal, and fringe supply routes, and the aorta. Critically, be that as it may, as plaques might be uprooted out, due to the supposed positive rebuilding, the luminal width may seem ordinary in spite of noteworthy infection. Today, the aim of envisioning and portraying the ailing blood vessel divider in patients has turned into reality with the utilization of a few imaging strategies [34]. Obtrusive procedures, for example, intravascular ultrasound (IVUS) and IVUS-determined systems, (for example, palpography, elastography, and virtual histology) can survey blood vessel rebuilding, plaque qualities of coronary supply routes, and optical intelligence tomography permits 'close histological' goals of plaque surface, giving critical morphological data, and is now standard in clinical research [35, 36]. [37]Such methods, once sufficiently approved, may possibly characterize the helplessness of coronary atherosclerotic plaques.

Atherosclerosis has been found to be a predominant disease that has been found to infect a significant proportion of the human beings at any cumulative point in their lives. However, there is an unmet need for focus on the minimally invasive techniques to identify and characterize the phenotypes which are at-risk of development of plaques. Moreover, in order to improve the consummation of the patients suffering from some type of cardiovascular disorders and also for evaluation of the treatment plans. The MRI has been found to be exclusively capable of addressing the lesser known diagnostic needs. However, the present data and the techniques available for the MRI show that the techniques used for the imaging of the walls of the vessels lack considerably a sufficient power to guide different and distinguished needs of the patients. To address this gap in the research, and practitioner profiling, the physicians have been known to scape and push at the boundaries of the MRI for the atherosclerosis. The resolution of the images used in this technique have been lacking image quality, in order to improve the evaluation of the constituents

of the plaques and also to obtain significant readings on the activity of the disease and also to analyze the inflammation. Thus, some of the important developments, with a specified focus on the emerging techniques using a high resolution MRI, through the usage of quantitative parameter with a focus on the mapping for better-quality characterization of the plaques and an innovative 19 to rectify the inflammation of the plaques.

Among the other recognized kinds of imaging techniques, the CT or the computed tomography has been used effectively for the evaluation and detection of the atherosclerosis. Two major kinds of the computer technique have been put to use and can be found in the studies i.e. the electron beam CT and the multiple row detector CT scans. The electron beam CT is formulated on the basis of a tungsten ring and uses a stationary i.e. non-moving tungsten ring to generate the required x-ray scans which are produced at a thickness of 3mm from which the coronary artey calcium can be calculated in order to evaluate the risk of the development of a cardiovascular disease or simply the prevalent risk by the cardiovascular [32, 38-41]. In a contrast the multiple row detector computed tomography technique uses a constantly rotating x-ray which is used to obtain a 0.5-0.7 mm thickness, during the breathing space i.e. the duration between inhaling and exhaling of a patient to record the result. The IV is used to produce CTA images which are also important sources of information on the presence of atherosclerotic plaques present within the arterial walls of the coronary [42, 43].

Efficacy of Magnetic Resonance Imaging

Fayad (2011) stated that MRI has turned out to be a key non-intrusive in-vivo imaging techniques for measurement and portrayal of atherosclerosis. Similar to ultrasound, the MRI doesn't reflect patients to the radiation of the and thus can be rehashed as frequently as necessary: it empowers estimation of plaque load (region and volume), luminal narrowing and plaque qualities. Moreover, with MRI it is conceivable to survey the thickness of the sinewy top which occasionally acts as a cover to the plaques and the degree of the lipid-rich necrotic centre (LRNC), just as adventitial neovascularization and intra-plaque drain. Picture procurement in MRI requires a high level of mastery albeit most estimations are decently administrator free. Furthermore, MRI imaging furnishes multi-planar 3D information with sub-millimeter spatial goals (Chung et.al, 2016). Most of the MRI of the vascular region has been accomplished on a 1.5T scanners. An increasing present-day imaging redundant at a higher rate to commotion with better goals contrasted with 1.5 T. The imaging conventions have developed, and successions have been upgraded enough at 3 T that it is commendable that future clinical examinations be directed with 3 T scanners.

The high reproducibility of MR brought about the capacity to lead restricted size investigations to exhibit proof of the idea. Truth be told, a few investigations have appeared huge changes in carotid atherosclerosis (territory or volume) can be identified with moderate example sizes (under 40 patients for each arm) inside the principal months or year of mediation. Yuan, Yang [44] watched plaque relapse inside 3 months of beginning statins in 24 treatment guileless patients with coronary conduit sickness [45]. Ryoo, Lee [46] determined that an examination with just 14 subjects for every arm is adequate to survey a 5% treatment impact if the plaque volume is utilized as an endpoint [47]. For a situation, control ponders, eight cases and eight control subjects were adequate to exhibit that delayed concentrated lipid-bringing down treatment is related to a decline in the lipid-rich necrotic centre. The intensity of MRI in appearing in atherosclerosis trouble in uncommon illnesses was unmistakably exhibited in two preliminaries utilizing another HDL-mimetic medication containing recombinant human apoA1 (CER-001) [48, 49].In the MODE preliminary after 12 fortnightly imbuements of CER-001 out of 23 patients influenced by homozygous familial hypercholesterolemia, MR imaging demonstrated a noteworthy decrease in carotid plaque region (p ¼ 0.008).

Corti, Fayad [50] stated that their study in vivo MRI thinks about records a decrease in atherosclerotic injury estimate actuated by statins in people. A critical perception was that at least a year of treatment was required to watch plaque changes. Actually, no progressions were distinguished at a half year, in spite of the normal hypolipidemic impact of simvastatin. Furthermore, they added that our information exhibit a critical decrease in plaque measure without lumen estimate changes [51].

X-ray has as of late been utilized to assess atherosclerosis, and a few mediation preliminaries with statins recommend that it can recognize atherosclerotic plaque relapse precisely. A noteworthy connection between LDL-C decrease and atherosclerosis relapse, bolstered by concentrates characterized obtrusively by angiography or IVUS, has been exhibited by both IMT and MRI. Subsequently, both these imaging strategies can be viewed as approved surrogate endpoints for atherosclerosis or the danger of CHD. Notwithstanding, because few investigations have decisively connected enhancements in atherosclerosis as identified by these techniques to decreases in cardiovascular occasions, prescient estimations of cardiovascular occasions assessed by these strategies need future examination. The expanded accessibility of EBCT and MSCT may additionally help the utilization of these novel imaging modalities in atherosclerosis intercession trials [52, 53].

From the study of [36, 54]data demonstrate that the statin used in premorbid treatments has been known to produce adjustments in the plaque upgraded through the symptomatic intracranial atherosclerotic plaque and diminishes the extent of patients with vast cortical areas of localized necrosis. Our outcomes underline the significance of suitable pre-stroke statin treatment for diminishing huge cortical infarct in patients with the intracranial atherosclerotic malady. What's more, cerebrovascular occasions likewise happened in high-portion statin clients, transcendently of the branch occlusive type, and their neurological seriousness was equivalent to that of nonusers. Further research on the improvement of preventive procedures for branch occlusion stroke is justified [55, 56]. Discoveries recommend MRI possibly offers an extra incentive through the evaluation of blood vessel structure in various areas and corresponding proportions of vascular capacity. In this manner, it appears to be progressively likely MRI will assume a key job in the assessment of new and existing treatments and may even turn out to be a piece of individual patient hazard evaluation. Report the adjustments in atherosclerosis trouble and blood vessel work in light of open mark statin treatment, in 24 statin-innocent recently

analyzed stable coronary conduit sickness patients. Patients experienced MRI previously, and 3 and a year in the wake of initiating treatment. Mean LDL-C fell by 37% to 70.8 mg/dL ($P < 0.01$). The plaque list (standardized vessel divider region) demonstrated decreases in the aorta (2.3%, $P < 0.05$) and carotid (3.1%, $P < 0.05$) conduits at 3 months. Early decreases in atherosclerosis of aorta and carotid saw at 3 months were fundamentally related with later change at a year ($R2 = 0.50$, $P < 0.001$; $R2 = 0.22$, $P < 0.05$, separately). Enhancements in aortic sensibility and brachial endothelial capacity that were clear following 3 months treatment were supported at the year time point.

The study of [52] states that ABI and PWV are basic and appropriate to all-inclusive community studies, and ready to distinguish of atherosclerosis to some degree, yet are not reasonable for following the relapse or movement of atherosclerosis in mediation preliminaries. IMT estimation is the best-settled, and longitudinal investigations have introduced the relapse of atherosclerosis by lipid-bringing down with statins. X-ray has as of late been utilized to assess atherosclerosis, and a few mediation preliminaries with statins recommend that it can recognize atherosclerotic plaque relapse precisely. A noteworthy connection between LDL-C decrease and atherosclerosis relapse, upheld by concentrates characterized intrusive by angiography or IVUS, has been exhibited by both IMT and MRI. Hence, both these imaging techniques can be viewed as approved surrogate endpoints for atherosclerosis or the danger of CHD.

In the examination of (Hosseini et.al, 2013), by pooling the accessible proof, three markers of the imaging were documented for intracranial plaques: differentiate improvement, constructive redesigning, and plaque anomaly, and these can prompt improved patient conclusion and better basic leadership for clinicians. As of late, the presence of examines with respect to intracranial vessel-divider MRI has been quickly expanding in the writing, however, they include impediments in the wording of the quality of the research. None of the conspicuous clinical advantage has been gotten from the utilization of intracranial vessel-divider MRI since few of the distributed considers had an imminent structure or included controlled examinations. Considering the present investigation, it is important to reinforce the hypothetical reason for future planned investigations by building up a strategy for morphologic-trademark portrayal also, an institutionalization of imaging parameters of intracranial plaques.

From the study of [57] outcomes propose that in spite of a huge level of distinguished heterogeneity of the distributed examinations, the nearness of IPH by MRI is related with an around 5.6-crease higher chance for cerebrovascular occasions as contrasted and the hazard for subjects without IPH. Be that as it may, in spite of the fact that this finding can't fill in as a justification for broad use of MRI in a clinical setting in subjects alluded for neurological workup, it frames the reason for bigger scale preliminaries and cost-adequacy examination with an extraordinary accentuation on orchestrated plan and detailing. Consequently, further work and mediation preliminaries will be important to at last decide if MR-based identification of plaque discharge may reliably hazard stratify patients into the individuals who profit by traditionalist versus interventional treatment.

The capacity of X-ray to separate the real parts of plaques conformed for atherosclerosis has been approved in the carotid vein just as the aorta. Though present cut off points on spatial goals ruin the ability of MRI to assess the coronary vessel divider and plaque, more current innovations, for example, high field quality magnets and complexity specialists, areas of now beating this impediment. Novel differentiate and sub-atomic specialists that objective high-chance highlights inside atherosclerotic plaque, similar to irritation and from- transport, are being created. IVMRI may assume a vital job in plaque imaging of the coronary veins because of its predominant spatial goals [58-60].

The usage of the MRI technique has been increasingly proposed for the evaluation and to investigate the conformation and the structure of the carotid atherosclerosis plaques, the reproducibility of the procedure needs some hindsight as well. Wüst, Calcagno [61] evaluated the efficacy and the reproducibility of the carotid atherosclerosis. The reproducibility of the MRI was evaluated so that the quantification and the documentation of the components of the plaques could be carried out. The plaque and the vessel quantification parts of the process can be reproduced. This feature of the MRI for the identification and overall evaluation of the carotid plaques has been deemed as acceptable. However, there has been incessant variability in the research domain that should be considered as well. The overall design of the studies for evaluation of the efficacy for determination of the elements that formulate the plaques differs in respect of the prognostics methods and the clinical trials are different as well.

FINDINGS

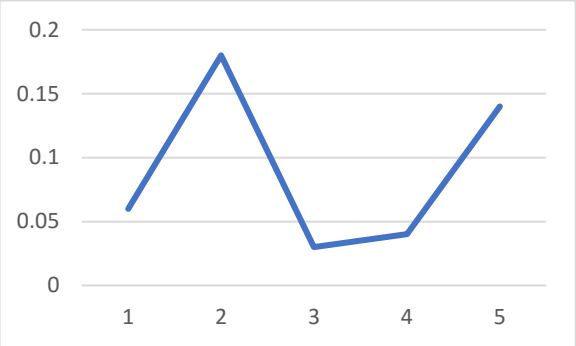
The systematic review of the present literature and the studies published in the last decade have been summarized in the previous section. In this part of the paper the major findings, the prognostic methods and the patient details have been presented. The analysis was performed on the basis and guidelines of a systematic review because the purpose of current study was to have a review of the studies conducted on the use of MRI in assessment of prognosis of Atherosclerosis plaques in patients under statin therapy. The major findings and the areas of the clinical trials have been presented in table 1.

Table 1. Baseline characteristics of included studies

Country	Patients	Design of Study	Mean Age	IM	IB	MRI Scanner (tesla)	Statin used (%)
South Korea	16	Prospective	60	T1WBB T2WBB PDWBB	Lumen Area Vessel area Plaque Thickness Wall era Normalized Wall index	5T	71.2
China	33	Prospective	68.1	T1WBB T2WBB PDWBB	Plaque Thickness Lipid core area cerebral artery Normalized Wall Index	4T	26.4
china	60	Prospective	58	T1W, T2W	Lipid core area Plaque Thickness Total vessel area Lumen Area Wall Area Normalized Wall Index	3T	14
China	61	Prospective	62.4	T1W	Normalized Wall index Internal carotid artery Middle cerebral artery Lumen Area	4T	72
South Korea	73	Prospective	72.4	T1WBB T2WBB	Lipid core area Plaque Thickness Total vessel area Lumen Area Wall Area	5T	21
UK	42	Prospective	73.4	T1WBB T2WBB PDWBB	Plaque Thickness Lipid core area cerebral artery Normalized Wall Index	3T	59.5
UK	61	Prospective	74	T1W T2W	Lipid core area Plaque Thickness Total vessel area Lumen Area Wall Area	4T	98.2
UK	64	Retrospective	72.7	T1WBB	Lumen Area Normalized Wall index Internal carotid artery Middle cerebral artery Plaque Thickness	2T	75
Canada	75	Prospective	74.9	T2WBB	Plaque Thickness Internal carotid artery Normalized Wall index Lumen Area Wall Area	6T	70.7

Japan	165	Prospective	70.9	PDWBB	Normalized Wall index Plaque Thickness Total vessel area Lumen Area Wall Area	3T	14.6

Graph 1: efficacy of MRI in the assessment of Atherosclerotic status in selected studies



The detailed systematic review shows that the technique of MRI is used by many hospitals for the sake of assessment of prognosis of Atherosclerosis plaques because MRI is very efficient in this regard. Many studies proved this, and the results of the current meta-analysis are also showing that the MRI is very efficient for assessing the prognosis of Atherosclerosis plaques.

Figure 1 is also showing that the scholars who have conducted a study on the efficacy of this assessment, they mostly found that assessment through MRI is increasing. However, the opinions of scholars about the efficacy of MRI in the prognosis of Atherosclerosis plaques is contrary to some extent. It was considered as effective in some studies but in some cases, it was considered not efficient. Thus, the existing studies have mixed opinion about the efficacy of MRI in the assessment of prognosis of Atherosclerosis plaques because some reported it as efficient while some reported is as not efficient. Table 2 reports the demographics of the patients reviewed through the study.

Table 2: Statistical analysis of the baseline demographics

Variable	Studies included	Atherosclerotic group	P-value
Number of patients	9	650	NA
Age (year)	9	68.68± 6.26	0.06
Imaging modality	9	26.3± 4.0	0.18
IB (mean ± SD)	6	42.4± 7.9	0.03
MRI scanner	1	3.9 ± 1.19	0.04
Statin (mean ±SD)	3	52.27± 30.3	0.14

DISCUSSION & CONCLUSION

The current study was aimed to have a systematic review of studies on the efficacy of MRI to assess the prognosis of Atherosclerosis plaques in the patients under statin therapy. Furthermore, the second objective of current study was to conduct a review of past ten year's studies on efficacy of MRI in assessment of prognosis of Atherosclerosis plaques. For this purpose, the data was collected through articles extracted from authentic databases and libraries. Articles were shortlisted through inclusion and exclusion criteria and then final sixty-five articles were used to perform systematic review. The reporting of these articles about imaging biomarkers, imaging modality, statin used, MRI scanner, study design, patients observed and mean of age of patients were extracted and their averages were calculated to reach final statistics to be interpreted. The findings show that the MRI is an efficient technique to assess the prognosis of Atherosclerosis plaques in the patients under statin therapy as indicated through majority of the studies included in meta-analysis. These findings find their considerable support from the findings of previous researchers e.g. [62-66]. The systematic review of related studies showed that MRI is a reliable predictor of Atherosclerosis plaques. However, some studies enrolled in current review study revealed that MRI is not a significant predictor for assessment of the prognosis of Atherosclerosis plaques. In this regard, different parameters have been observed to study this assessment and efficacy including vessel wall area, normalized wall index, lumen area etc. It is reported by some studies that there has been no clear histological proof for plaque hemorrhage on plaque MRI [63].

There are certain limitations of MRI detection reported by scholars including the low occurrence rate of IPH at stenosis. Furthermore, some studies reported that there is no significant and direct clinical benefit gained through vessel wall MRI regarding the prognosis of Atherosclerosis plaques. Hence, the opinions of scholars are not aligned about the efficacy of different parameters of MRI in assessment of the prognosis of Atherosclerosis plaques therefore; there is no harmony of researchers about it. Based on systematic review and current results, it is found that there is lack of harmony and theoretical basis about efficacy of imaging parameters to assess the prognosis of Atherosclerosis plaques.

Conclusion

The thorough systematic review showed that the views of different scholars about the efficacy of MRI in assessment of the prognosis of Atherosclerosis plaques are mixed and are not harmonized. Since some studies enrolled in current study provided the reporting that MRI and its different parameters are proved as an efficient technique to assess the prognosis of Atherosclerosis plaques while some other scholars reported the contrary results therefore, the findings reveal that there is lack of theoretical basis and harmony about its efficacy. There are some limitations of existing study as well as literature that need to be eliminated in future. The first limitation is about

the inclusion and exclusion criteria of current meta-analysis as the current study only enrolled those studies in systematic review that were conducted on patients of Atherosclerosis plaques under statin therapy while all other studies were eliminated from enrolment. The findings and their status in studies conducted on patients under different therapies may be different. Furthermore, the existing literature reveals a deep gap about the harmony of scholars about the efficacy of MRI in assessment of the prognosis of Atherosclerosis plaque. The future researcher is suggested to conduct more prospective studies in this regard at large-scale so that the efficacy of MRI in this assessment can be ensured. The current review should also be performed at large level by conducting it with the enrolment of studies that have been observed on patients of Atherosclerosis plaques under different therapies to study the efficacy of MRI. Another limitation of current study is that it enrolled studies with the priority of specific parameters while studies using other parameters excluded. The key parameters prioritized for current purpose are lipid core area, plaque thickness, total vessel area, lumen area, normalized wall index, wall area and cerebral artery. Further researchers are directed to conduct review at large scale with enrolment of studies using wide range of parameters of MRI in assessment of the prognosis of Atherosclerosis plaques.

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