History of Medicine, 2023, 9(1): 1990–1992
DOI: 10.17720/2409-5834.v9.1.2023.257

Role of Amyloid A in atherosclerosis risk prediction

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Received: 28 January 2023 **Accepted:** 19 April 2023

Citation: Al Alwany AA, Ahlamalilafta, Majeed MJ (2023) Morphometric Role of Amyloid A in atherosclerosis risk prediction. History of Medicine 9(1): 1990−1=1992. https://doi.org/10.17720/2409-5834.v9.1.2023.257

Abstract

Background The study attempts to find a predictive and diagnostic method for atherosclerosis through its relationship with atherosclerosis and general inflammation Aim Determine the serum amyloid A and highly sensitive c- reactive protein(CRP) level in early diagnostic parameters of acute phase reactant protein of patients with a low level of ionizedCawho represent the category at risk of atherosclerosis. Subjects, Material and Method The patients were divided into two groups according to the level ofionizedCa more than 4 (mg/dl)and less than 4(mg/dl), their ages ranged between (50-60 years), and tested them for serum ox-LDL,troponin, amyloid A and CRP. Results It can notice a significant ($p \leq 0.05$) increase inacute phase proteins serum CRP Mean ± SD (200 ± 20.28) (mg/L), and amyloid A (2.8 ± 7.88) (mg/L) before the rise in serum troponin (97.19 ± 9.9) (ng /L), which was found to be non-significant ($p > 0.05$) at this stage, with a decrease in the level of Ca-ionized less than 4 (mg/dl). Conclusion It can be considered serum amyloid A as well asc- reactive protein (CRP) a diagnostic biomarker for the future of atherosclerosis events assuming that atherosclerosis risk is associated with low serum ionizedCalevel.

Keywords

Serum ionizedCa, serum amyloid A, serum CRP

Acute phase serum amyloid A (SAA) and C-reactive protein (CRP) are acute-phase reactants synthesized in the liver (Sack, et al.,2020), is persistently elevated in chronic inflammatory conditions, and elevated levels predict cardiovascular risk in humans. More recently, murine studies have demonstrated that over-expression of SAA increases and deficiencysuppression of SAA attenuates atherosclerosis. Thus, beyond being a biomarker, SAA appears to play a causal role in atherogenesis. The purpose of this review is to summarize the data supporting SAA as a key player in atherosclerosis development (Shridas P, etal.,2019).

The level of c-reactive protein can be an indicator of how at risk you are for developing cardiovascular problems. This is because the development of atherosclerosis (laying down of cholesterol inside the blood vessel walls) is associated with inflammation within the vessel walls (Alfaddagh, etal.,2020).

Subjects, Material and Method

The patients were divided into two groups according to this serum ionized Ca their serum level based on the cut-off value which was determined by ROC analysis obtained from the Ca-score and it was equal to 4.24 (mg/dl), their ages ranged between (50-60 years), tested them for serum ox-LDL,troponin, amyloid A and CRP which was determined by:

first group: patients who have ionizedCa is less than 4(mg/dl) and their Ca-score in high level.

second group: patients who have ionizedCa more than 4 (mg/dl) and whose Ca-score is the normal level.

Discussion

Serum ionized Calevel was low, which is in line with the mechanicsthat suggest, that coronary artery

calcifications may occur due to the release of calcium when smooth muscle cells die in the heart's arteries (Cozzolino, etal,.2019). In a simple explanation, macrophages (immune system cells) in the arteries may release inflammatory compounds that allow calcium to deposit more easily. Over time, the calcium deposits combine to form "speckles" or spots that can later develop into sheets or fragments (Thankam, etal,.2021).

There are a variety of conditions that have been found to be associated with systemic AA amyloidosis. These include chronic inflammatory arthropathies (rheumatoid arthritis being the most widely reported), chronic infections, periodic fever syndromes, inflammatory bowel disease, and vasculitis(Papa, etal.,2018).

Elevated plasma SAA levels predict increased cardiovascular risk and portend worse prognosis in patients with acute coronary artery disease (CAD). The pathophysiological role of SAA remains enigmatic. SAA plays a role in host defense, but it might also be atherogenic. SAA affects cholesterol transport, contributes to endothelial dysfunction, promotes thrombosis, evokes recruitment of inflammatory cells, activates neutrophils and suppresses neutrophil apoptosis, key events underlying acute coronary syndromes. These results provide a potential link between SAA and CAD and suggest that reducing SAA levels or opposing the actions of SAA may have beneficial effects in patients with acute CAD(Medina-Leyte, etal.,2021).

The production of CRP is increased in atherosclerosis and other cardiovascular diseases which involve low-grade systemic inflammation (Collado, etal.,2021), CRP seems to predict the chance of having cardiovascular problems at least as well as cholesterol levels. A recent study found that elevated levels of c-reactive protein were associated with a three-times-greater risk of a heart attack (Saleh, etal.,2022)

high levels of inflammation in the body that boost the serum A protein levels in the bloodstream, if infection or in inflammation lasts for a long period, the induvial may have high serum amyloid A (Nehring SM, etal.,2022).

As heart damage increases, greater amounts of troponin are released in the blood. High levels of troponin in the blood may mean of having or recently had a heart attack. A heart attack happens when blood flow to the heart gets blocked(Al Alwany, etal.,2022).

Persistent and modest elevation of cardiac troponin level is frequently observed and reflects ongoing subclinical myocardial damage in patients with various non-ischemic cardiomyopathies. It has been reported that cardiac troponin levels are higher in patients with cardiac amyloidosis compared with other (Takashio, etal.,2018).

Oxidized low-density lipoprotein (ox-LDL) contributes to the atherosclerotic plaque formation and progression by several mechanisms, including the induction of endothelial cell activation and dysfunction, macrophage foam cell formation, and smooth muscle cell migration and proliferation (Ahmadi, etal,.2021). oxidized LDL triggers inflammation leading to the formation of plaque in the arteries, also known as atherosclerosis. Oxidized LDL may also play a role in increasing the number of triglycerides the body produces, as well as increasing the amount of fat deposited by the body (Khatana, etal,.2020).

The current study found an increase in the markers associated with a decrease in the level of calcium ions. This was observed before the level of troponin increased, which suggests it to be an early diagnostic indicator holding the risk of atherosclerosis associated with a decrease in the level of calcium ions (Dhara, etal.,2020).

Results

Both groups of patientswho have serum ionized Ca below and more than 4(mg/dl)show non-significant ($p > 0.05$) differences in the level of each serum troponin and ox-LDL, while patients who ionized Ca below have significant ($p \leq 0.05$) elevation in the level of serum amyloid A and CRP in comparison with the p-value who have ionized Ca more than 4(mg/dl).

Table1: Mean ± SD of serum acute phase proteins, troponin and Oxidized LDL in patients who have with ionized Ca less than 4 (mg/dl)& patients who have with ionized Ca more than 4(mg/dl).

Parameters	Groups	No.	Mean ± SD	P-value
S. CRP (mg/L)	Patients who have with ionized Ca less than 4(mg/dl)(a)	25	200 ± 20.28	P ≤ 0.05 Sig.
	Patients who have with ionized Ca more than 4(mg/dl)(b)	25	7.55 ± 1.8	
S. amyloid A(mg/L)	Patients home have with ionized Ca less than 4 (mg/dl)(a)	25	2.8 ± 7.88	P ≤ 0.05 Sig.
	Patients home have with ionized Ca more than 4(mg/dl)(b)	25	0.99 ± 2.5	
S. ox-LDL (ng /ml)	Patients home have with ionized Ca less than 4 (a)	25	19.10 ± 2.28	P > 0.05 Non. sig
	Patients home have with ionized Ca more than 4 (b)	25	19.51 ± 1.12	
S. troponin (ng /L)	Patients home have with ionized Ca less than 4 (a)	25	97.19 ± 9.9	P > 0.05 Non. sig
	Patients home have with ionized Ca more than 4 (b)	25	98.62 ± 12.5	

sig.=significant P≤0.05, non. sig. =non-significant P>0.05, SD=fisher least significant difference, S=serum. Serum ionized Ca show a positive significant correlation with each of serum ox-LDL ($r= 0.38$, $P \leq 0.05$), serum amyloid A ($r= 0.8$, $P < 0.05$) and serum CRP ($r= 0.65$, $P < 0.05$). while show non-significant ($P > 0.05$) with serum troponin.

Table 2: Persons' correlation of serum ionized Ca and each of ox-LDL, troponin, amyloid A and CRP.

Parameters	Serum ionized Ca less than 4 r =	P-value
S. ox-LDL (ng /ml)	0.38	P ≤ 0.05
S. troponin (ng /L)	0.09	P > 0.05
S. amyloid A	0.8	P < 0.05
S. CRP	0.65	P < 0.05

sig.=significant P≤0.05, non. sig. =non-significant P>0.05, SD=fisher least significant difference, S=serum.

Conclusion

It can be considered serum amyloid A as well as CRP as a diagnostic biomarker for the future of atherosclerosis events assuming that atherosclerosis risk is associated with low serum ionized calcium level.

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