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Original Research Article

Evaluation of the lipid parameters in chronic heart failure patients and their correlation with body mass index

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ABSTRACT

Background: Increased body mass index (BMI) is associated with dyslipidemia, but relevant data in patients with cardiac morbidity is scarce. This study assessed lipid parameters in chronic heart failure (CHF) patients and their statistical correlation with BMI.
Methods: The retrospective study utilized data of CHF patients who visited Madhavbaug clinics in India between July-December 2018. Serum lipid profile noted were total cholesterol (TC), triglycerides (TG), low-density lipoproteins (LDL), high-density lipoproteins (HDL) and very low-density lipoproteins (VLDL). Patients were classified based on BMI (normal, overweight, obese) and their mean lipid parameters were compared.
Results: Out of 147 patients, 74.15% were males with mean age 59.15±10.28 years and mean BMI 26.69±4.97 kg/m2. 56 patients had normal BMI, 60 were overweight and 30 were obese. Mean TC, TG and LDL levels in the normal-BMI group were significantly lower than that in overweight and obese groups ($p<0.05$). Mean HDL and VLDL were found to be higher in overweight group as compared to that in normal-BMI and obese group ($p<0.05$). Weak positive correlations were found between BMI and TC ($R=0.09$, $p>0.05$), BMI and TG ($R=0.07$, $p>0.05$), BMI and LDL ($R=0.09$, $p>0.05$) as well as BMI and VLDL ($R=0.02$, $p>0.05$). There was inverse correlation seen between BMI and HDL ($R=-0.12$, $p>0.05$).
Conclusions: Increase in BMI was associated with dyslipidemia in CHF patients. There was positive correlation of BMI with LDL, TG, TC as well as VLDL while there was negative correlation between BMI and HDL levels. Obesity may increase the dyslipidemia risk in CHF patients which may affect their prognosis.

Keywords: Body mass Index, Dyslipidemia, Lipid profile, Obesity

INTRODUCTION

The prevalence of cardiovascular diseases (CVD) are rising globally, so much so that they have become the commonest cause of mortality in India.[1] Chronic heart failure (CHF) has affected about 10 million people in India according to published data and remains one of the most common CVDs to affect the Indian population.[2] Obesity is another health issue which is no less than a global epidemic. Multiple studies in India have shown that the prevalence of overweight population and obese individuals in India ranges between 30% to 65%.[3] Obesity has also been shown to have a direct correlation with the rising prevalence of various metabolic diseases like dyslipidemia, hypertension (HTN) and type II diabetes mellitus (DM), all of which are important contributory factors for CVDs and CHF.[4,5]

According to the published data in the Indian context, the problem of dyslipidemia is something which is prevalent in the country. One study done on rural population stated that 79% people had abnormalities in one of the lipid parameters.[6] Researchers have found that the derangement in the lipid parameters, like increased serum total cholesterol (TC), triglycerides (TG) and low-density lipoproteins (LDL), are linked with increased chances of developing CVDs, and poor outcomes in patients already having CHF.[7] The Adult Treatment Panel III (ATP III) from the National Cholesterol Education Program (NCEP) have stated that elevated LDL, TG and lower high-density lipoproteins (HDL) are associated with overweight and obesity. Body mass index (BMI), which is used to indicate the presence or absence of obesity in the population, is considered to be an important determinant of CHF risk and prognosis.[8]

An Indian study conducted in Southern India found that there was an increased risk of dyslipidemia in the population having high BMI compared to those having normal BMI.[9] A similar recent study was conducted in Northern India, showing positive association between BMI and dyslipidemia.[10] However, these studies were done in the population having no cardiac co-morbidity. Also, these studies did not evaluate the correlation between the BMI and lipid parameters to check for any positive or negative statistical correlation. Hence, the present study was planned to evaluate the lipid parameters in CHF patients and their statistical correlation with BMI.

METHODS

This retrospective study was conducted utilizing the data of CHF patients who visited the Madhavbaug clinics in Maharashtra state of India between July 2018 to December 2018. The case record files of these patients were assessed for completeness of the baseline characteristics, viz. demographic details, body mass index (BMI) as well as the lipid profile. Data of only those patients was noted down and analyzed who had completeness of the case record documents.

The CHF patients who came to the Madhavbaug clinics for the first time were subjected to general and systemic examination, which was followed by blood collection from the patients in sitting position, to assess the lipid profile. The parameters assessed under lipid profile included serum total cholesterol (TC), serum triglycerides (TG), serum low density lipoproteins (LDL), serum high density lipoproteins (HDL) and serum very low-density lipoproteins (VLDL) (Table 1). The results of the lipid profile were obtained from pathology laboratory and were noted down in the case records.

The patients were classified as those having BMI in the normal range, overweight or obese based on the WHO classification of patients created on BMI. The BMI between 18-24.9 kg/m^2 was considered in the normal range, patients' BMI between 25-29.9 kg/m^2 was considered overweight, whereas those having BMI above 30 kg/m^2 were considered obese.[11]

Table 1: Normal range for lipid profile.

Variables assessed (mg/dl)	Normal range
Serum cholesterol	<200 mg/dl
Serum triglyceride (TG)	<150 mg/dl
Serum HDL	>60 mg/dl
Serum LDL	<130 mg/dl
Serum VLDL	<30 mg/dl

Data entry was done in Microsoft Excel 2016. Graphpad Instat software was used for analysis of the data collected. Categorical data were represented in the numerical form whereas continuous data were described as mean ±SD. The mean values of all the lipid parameters were compared between the groups classified based on BMI (normal versus overweight, normal versus obese and overweight versus obese) using unpaired T test. P value of less than 0.05 was considered statistically significant. Pearson correlation coefficient tests were used to analyze the correlation of BMI with each of the lipid parameters.

RESULTS

147 patients who visited the Madhavbaug clinics between the specified study duration fulfilled the study criteria. The data of all these patients was considered in the study. The demographic details were noted down, and it was recognized that majority patients were males (N=109, 74.15%). The mean age of the CHF patients included in this study was 59.15+10.28 years, with a mean weight of 69.21±14.39 kilograms and a mean height of 1.6±0.08 meters. The mean BMI was calculated for all the patients and it was found to be 26.69 kg/m^2 (Table 2).

Table 2: Demographic details of CHF patients (n=147).

Parameters	Values
Mean age (years)	59.15±10.28
Median age (years)	59 (Range: 30-80)
Number of males	109 (74.15%)
Number of females	38 (25.85%)
Mean baseline weight (kg)	69.21±14.39
Mean baseline height (meter)	1.6±0.08
Mean Body mass index (BMI) (kg/m^2)	26.69±4.97

Based on the WHO guidelines, the patients were then classified as per the BMI classification - the CHF patients having normal BMI, those who were overweight and those who were obese (Table 3).

There were 56 patients were having normal BMI, 60 patients were having BMI in the over-weight range, while the remaining 30 were obese based on their BMI.

Table 3: Classification of patients based on BMI (n=147).

Normal BMI (18.5-24.99 kg/m^2)	Overweight (25-29.99 kg/m^2)	Obese (>30 kg/m^2)
56	60	30

The mean values for all the lipid parameters were calculated based on their BMI-based subgroups and the comparison of these mean values was made between the sub-groups. The mean serum TC, the mean serum TG and the mean LDL levels in the normal-BMI group were significantly lower than that in the overweight and the obese groups (p<0.05). The serum HDL was found to be higher in the overweight group as compared to the normal-BMI group and the obese group (p<0.05). There was no statistically significant difference between the serum HDL in the normal-BMI and the obese group of patients (p>0.05). The serum VLDL levels were found to be maximum in the overweight group, which was significantly more than both the other subgroups. As was the case with serum HDL, there was no statistical difference between the normal-BMI and the obese groups (p>0.05). These results have been summarized in Table 4.

Table 4: Comparison of Lipid profile according to BMI parameters in CHF patients.

Variables assessed (mg/dl)	BMI			P value		
	Normal (18.5-24.99 kg/m^2) (N=56) [Group A]	Overweight (25-29.99 kg/m^2) (N=60) [Group B]	Obese (>30 kg/m^2) (N=30) [Group C]	Group A vs B	Group A vs C	Group B vs C
Serum cholesterol	143.34±38.58	161.38±51.81	159.77±47.76	<0.01*	<0.01*	0.24
Serum triglyceride	111.98±51.84	148.36±132.52	128.52±49.89	<0.01*	<0.01*	<0.01*
Serum HDL	43.78±11.73	46.52±12.59	42.9±8.64	0.02*	0.15	<0.01*
Serum LDL	76.64±33.6	84.66±41.69	91.39±41.51	<0.01*	<0.01*	<0.01*
Serum VLDL	26.96±20.47	32.36±27.9	25.66±9.98	<0.01*	0.21	<0.01*

P<0.05 by Unpaired t test between specified groups

On using the Pearson's correlation test, it was found that there were weak positive correlations between BMI and serum TC (R=0.09, p>0.05), BMI and serum TG (R=0.07, p>0.05), BMI and serum LDL (R=0.09, p>0.05) as well as between BMI and serum VLDL (R=0.02, p>0.05). There was an inverse, or negative, correlation seen between BMI and serum HDL (R=-0.12, p>0.05). However, none of these correlations were statistically significant Table 5.

Table 5: Correlation between BMI and lipid parameters in patients of CHF

Variables assessed	R (Correlation coefficient)	Interpretation	P value
Serum cholesterol	0.09	Weak positive correlation	0.23
Serum triglyceride	0.07	Weak positive correlation	0.35
Serum HDL	-0.12	Weak negative correlation	0.15
Serum LDL	0.09	Weak positive correlation	0.27
Serum VLDL	0.02	Weak positive correlation	0.72

Correlation coefficient obtained by Pearson correlation coefficient testing. P<0.05 considered significant

DISCUSSION

Increased BMI influences the prognosis of CVDs mainly by its indirect association with development of metabolic diseases like dyslipidemia, HTN and DM. An increase in the BMI has been stated to affect the lipid parameters in a detrimental way, by increasing the serum LDL, serum TG, serum TC and decreasing the serum HDL. Though Indian data is there in this context, none of the studies have evaluated the association of BMI and dyslipidemia in CHF patients. Also, none of the Indian studies have statistically correlated the mean lipid parameters with the BMI values individually. Hence, this study was planned to evaluate the lipid profile of CHF patients as well as statistically correlate the same with BMI values.

The baseline lipid parameters analyzed based on the data available of 147 patients were serum TC, serum LDL, serum TG, serum HDL and serum VLDL. On analysis, it was found that the serum TC, serum TG and serum LDL were all significantly lower (p<0.05) in the normal-BMI group. However, in all the three sub-groups, these mean lipid parameters were all in the normal range. Still, the significantly higher mean levels of these parameters in the overweight and obese groups indicates probable relation between increased BMI and dyslipidemia. The serum HDL levels were paradoxically higher in the

overweight group, significantly more than the normal-BMI patients. The mean serum HDL were comparable in the normal BMI and obese patients. In all the patients, the mean HDL levels were below the normal range, indicating dyslipidemia. Hence, the lower-than-normal HDL in all CHF patients indicates lack of association between BMI and serum HDL levels. The mean serum VLDL was highest in the overweight group which was significant ($p<0.05$), while that in the normal-BMI group and obese groups were comparable. Only the overweight group had mean serum VLDL above the normal range (30 mg/dl), indicating possible association between increased BMI and elevated VLDL levels.

On analyzing the correlation between the BMI of each CHF patient with their assessed lipid parameters, it was found that there was positive correlation between BMI with serum TC, serum TG, serum LDL and serum VLDL. This indicates that an increase in the BMI is statistically correlated with the increase in these lipid parameters, giving rise to dyslipidemia. Also, there was negative correlation between BMI and serum HDL, indicating lower serum HDL levels with increasing BMI, once again suggesting dyslipidemia. However, these correlations were not statistically significant and hence, more studies need to be planned to create real world evidence regarding the correlation between BMI and lipid parameters.

Literature search did not yield any study like this, with CHF patients. However, similar studies have been done to compare lipid profile in the general population with normal and high BMI. In a study conducted by Ranganathan et al. in South India, the authors found that the serum LDL, VLDL as well as TG were significantly high in the high-BMI group compared to those with normal BMI ($p<0.05$). The study concluded that individuals with high BMI have more risk of dyslipidemia.[9] A similar conclusion was drawn in a study conducted by Archana et al. and published recently.[10] Despite the presence of these few studies, there is a clear lack of evidence from South Asia, especially in patients with co-morbidities like CHF. Lipid disorders are associated with increase in the all-cause mortality in CHF patients and hence it is important to monitor the lipid status in these patients.[12] From our study, we can state that controlling the BMI can be helpful in combatting dyslipidemia, which can benefit the prognosis of CHF patients.

It will not be wrong to say that due to modern civilization, there has been an increase in the comfort for day-to-day activities, and a drastic change in the lifestyle of the population. Also, the advent of the fast-food era has led to more risk of developing obesity as well as dyslipidemia. The change in the lifestyle, food habits as well as decreased physical activity pose an imminent threat of obesity as well as dyslipidemia in both, the developed and the developing countries.[12] The lack of awareness about the possible influence of obesity on health and optimal management options is a serious concern, which demands to be addressed with care on part of the healthcare professionals.[13]

The study was not without few limitations. The sample size was less and hence it will be better if conclusions be drawn after conducting more such studies in the real world. This study was conducted only in Western India population. Future studies should be conducted at multiple centers so that population from all regions of India can be represented.

CONCLUSION

This study demonstrates that increase in BMI is associated with occurrence of dyslipidemia in the CHF patients. There was positive correlation between BMI and serum TC, TG, LDL and VLDL while there was negative correlation between BMI and serum HDL levels. Thus, obesity increases the risk of dyslipidemia in CHF patients which may affect the prognosis of these patients. The healthcare professionals should keep in mind the obesity and dyslipidemia associations and urge the CHF patients to adopt lifestyle modifications to keep the BMI in check.

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