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RESEARCH ARTICLE

LEFT VENTRICULAR (LV) CLOT IN PATIENTS WITH ST ELEVATION MYOCARDIAL INFARCTION

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Abstract

CAD is the leading cause of death throughout the world. Regarding the complication of myocardial infarction, the left ventricular thrombus (LVT) formation is of greater concern. Once the LVT is formed, it possesses increase potential to embolise systemically and may complicate a serious life- threatening condition i.e. stroke.

Objective: To find out the frequency of LV clots in patients presenting with myocardial infarction.

Method: Diagnosed MI patients were included in this study based on a convenient sampling technique. The data was collected through a standard pro forma and was analyzed through SPSS . The P-value was calculated to determine the significance of the result.

Results: Out of 168 patients with MI, 118 (70.2%) were males and 50 (29.8%) were females. The mean age was 55.46 ± 9.54 years. On Echo, 17 (10%) patients had LVT, of which 10 cases were from male gender and seven from females. The frequency of LVT was higher in anterior MI in 16 out of 17 LVT cases (94.1%), and in other types of MI, the frequency was lower, 1 case out of 17 cases (5.9%). The frequency of LVT was also higher in the age group >50 years (70%) and was lower in the age group <50 years (30%).

Conclusion: LV clot is a common complication after MI, and the frequency of LVT is more common in the age group greater than fifty and associated more with anterior MI.

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Introduction:-

Coronary artery disease is the leading cause of cardiovascular death throughout the globe. The disease is coming on the decline in the Western world, but it is increasing to an alarming state in the Asian . Therefore, it is responsible for almost half of death in the Asian world, especially in our country, and for nearly one-fourth in the western world, especially.1 Acute myocardial infarction(AMI) constitutes half of the cardiovascular death resulting from coronary heart disease(CHD). (1) It is said that coronary heart disease(CHD) is likely to become the leading cause of death worldwide closely in the nearby future. In addition, some researchers thought that the number of deaths due to coronary heart disease is increasing at a shocking rate and will be the most common cause of death throughout the entire globe by 2020. (1) As for the complications of myocardial infarction(MI), the left ventricular clot is the frequent and most fatal complication of acute myocardial infarction (1), because of the associated increased risk of clot dislodgement and systemic embolization, this constitutes, as a result, in the most common and higher death ratio

after acute myocardial infarction (AMI). (1) The site of MI and the size of the damage to the myocardium (heart muscles) are the most vital and independent predictors of left ventricular (LV) clot formation regardless of numerous treatments. (1) The clinical importance of left ventricular (LV) clot formation lies in its systemic mobilization because it is verified that as the clot dislodges of the left ventricular cavity (due to any reason), it may result in stroke, intestinal and limb ischemia, etc. these circumstances has been found and written in many kinds of literature. (1)

Mostly the clot (thrombus) formation occurs in the left ventricle (LV) but especially at the apex of the left ventricle or along with the interventricular septum at the left ventricular side. (2) The frequency of LV clot is much higher in the anterior infarcts and accounts for as much as 98% of all cases. Compare to the other site of infarction, the frequency in other infarctions is only 2%. Conversely, the frequency is higher in larger infarction than in small infarcts. (2)

The mural thrombi are that which is attached to the endocardial surface, overlying the necrotized myocardium. The superior part of the mural thrombi (clot) may detach and can result in a life-threatening systemic arterial embolism. (2)

The echocardiographic features suggesting most probably embolization of the clot are as follows(2) 1: Increased movements (mobility) of the clot.

2: Bulging of the clot into the ventricular cavity and,

3: The clot, which has been seen in different echocardiographic views with the continuous area of akinesia or hypokinesia of the affected LV wall(2)(3)(4).

It should be noted that only MI is not the solitary etiology of LV thrombosis. Some other conditions are linked with this complication, like cardiomyopathies, Löffler's disease, endomyocardial fibrosis, eosinophilic leukemia, and myocarditis, etc. (2). The most important aspect regarding the left ventricular clot is not its presence but its potential to embolize systemically. The focus of this study is to find a left ventricular clot after acute myocardial infarction.

In subjects with acute myocardial infarction, systemic embolization results in about 10% of all patients. (1) Hence thromboembolism is considering to be the contributing cause of death in patients with ST-elevation myocardial infarction (STEMI) and accounts for almost 25% Of deaths in MI patients after admitting to the hospital. (1)

Although there is a lot of data regarding this topic is available internationally as considerable work has been done on this topic, but there is a huge scarcity of work and available data locally. Therefore, this research is design in a manner to focus on finding the magnitude of LV clot in patients with acute myocardial infarction. The results of this research may be then used as a guide for future recommendations for the diagnosis of this complication and also as a guide for treating strategies in patients who already have a myocardial infarction (old MI patients) because the huge magnitude of left ventricular clot gives the notice for early diagnosis and management of this prognostic life-threatening yet a silent complication of MI.

The pathophysiology of LV clot formation in the so-called "Virchow's triad" was first postulated in patients with AMI and those patients having cardiomyopathies or congestive heart failure (CHF). (5)

The triad constitutes endothelial injury, the state of hypercoagulation, and the stasis of blood. The regional wall akinesia, hypokinesia, or dyskinesia of the left ventricle results in the stasis of blood, the long-lasting ischemia leads to an inflammatory cascade which then leads to the initiation of the state of hypercoagulation, and the endothelial injury is often referred to as Virchow's triad which is responsible for clot formation in the heart or anywhere in the cardiovascular system. The composition of this clot is mostly platelets, red cells, and fibrin. (5)

The formation of the left ventricular clot was first highlighted by Garvin(6), who studied about 771 patients successively, which were dying of heart disease. (6) He discovered intracardiac mural thrombi in 34% of patients having coronary heart disease, the most common cause of LV clot formation.

The literature reviews of previously published papers of patients from 1926-1985 have shown the frequency of 8-85% (mean=45%). (7) These results are similar to the early research work of Beans in 1960 in which Beans selected

300 patients with AMI, and he found that 51% of these patients had an intracardiac clot. The frequency of clot formation in patients with fatal acute AMI have a tendency higher than those patients having old or healed MI.(8)(9)

Forood has discovered by performing an autopsy study on about 39000 subjects that 34% had thrombus in their LV cavity. (9) Shortly after four years Jordan and colleagues found that 38% of necropsy subjects had clot after acute MI and 24% had clot after healed MI.(8)

As for the age of the patients, Garvin(6) didn't mention the age of the patients as an associated factor with the increased frequency of intracardiac clot formation, but later on, the study by Yeter and colleagues suggested that the patients older than 50 years had a higher tendency to the formation of intracardiac thrombi. The patients older than 50 years were having a clot in the LV cavity in 56% of cases and 36%-37% in those younger than 50 years. (6)

The study was aimed to determine the frequency of left ventricular clots in different types of myocardial infarction in patients of all age groups as it was not determined in previous studies. If the frequency of left ventricular clots in these patients was proved in our study, it would give great confidence and gaudiness about left ventricular clots in MI patients of all age groups.

Material And Method:-

Our study was a cross-sectional study of 168 patients with myocardial infarction who presented to Cardiology from October 2019 to October 2020. The diagnosis of left ventricular clot was based on Echocardiography. All the data was collected through a structured pro forma. During this cross-sectional study, the patients belong to all ages, and both genders were included. The patients with only an LV clot with no history of MI were excluded from the study. Other patients, including that of Cardiomyopathies (dilated, restrictive and hypertrophic, etc.) with LV clot, were also excluded. This criterion was applied to the research to assess the LV clot resulting only from MI not from other causes as the clot formation occurs in other diseases also, i.e., in cardiomyopathies, congenital heart diseases, hypercoagulable states, etc. The statistical analysis of the data was done through SPSS 22 for the determination of the significance of the result.

Results:-

Out of a total of 168 myocardial infarction (MI) patients, 118 (70.2%) were males, and 50 (29.8%) were females. The number of male patients was more (Table 1).

Table 1:- Gender distribution.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------|-----------|---------|---------------|--------------------|
| Valid | Male | 118 | 70.2 | 70.2 | 70.2 |
| | Female | 50 | 29.8 | 29.8 | 100.0 |
| | Total | 168 | 100.0 | 100.0 | |

The mean age was 55.90 ± 8.99 , and age was further divided into five sub-groups. The age group 31-40 years constituted a total of 9 (5.4%) MI cases in which 8 were males, and only one was female. In the age group 41-50 years, the total subjects of AMI were 41(24.4%), of which 32 were males, and 9 were females. The age group 51-60 years presented the highest frequency of AMI cases in which there were 73 (43.5%) total cases, and of these, 47 were males, and 26 were females. The total subjects of age 61-70 years were 38 (22.5%), of which 20 were males, and 10 were females. The last age group, which was ≥ 71 years, constituted a total of 7 (4.2%) of which 3 were males, and 4 were females. (Table 2).

Table 2:- Sex of Research participants in different age groups.

| | | Gender | | Total | Percentages |
|-----|-------|--------|--------|-------|-------------|
| | | Male | Female | | |
| Age | 31-40 | 8 | 1 | 9 | 5.4% |
| | 41-50 | 32 | 9 | 41 | 24.4% |
| | 51-60 | 47 | 26 | 73 | 43.5% |
| | 61-70 | 28 | 10 | 38 | 22.5% |

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|-------|-----|-----|----|-----|------|
| | ≥71 | 3 | 4 | 7 | 4.2% |
| Total | | 118 | 50 | 168 | 100% |

All of the patients were diagnosed with an LV clot on Echocardiography. The left ventricular clot was present in 17 (10%) out of a total of 168 MI cases. The population of the male gender constituted 118 (70.2%) individuals and 50 (29.8%) females, respectively. In total, 50 cases, 7 (14%) females had an LV clot, and out of 118 males, 10 (8.5%) had an LV clot (Table 3)

Table 3:- Distribution of Gender with LV Clot.

| | | LV_clot | | Total |
|--------|--------|----------|--------------|------------|
| | | Present | Absent | |
| Gender | Male | 10(8.5%) | 108 (91.5%) | 118 (70%) |
| | Female | 7(14%) | 43 (86%) | 50 (29.8%) |
| Total | | 17(10%) | 151(89.88%) | 168 |

In extensive anterior MI, in a total of 13 cases, 3 (23%) had LV clot (LVT), and 10 had no LVT. In total, 25 cases of anterolateral MI, the LVT was present in 5 (20%) cases, the antero-septal MI scored the highest frequency, constituted 62 cases in which 6 (9.6%) patients had LVT, and the remaining had no LVT. The inferior MI constituted a total of 38 cases in which only 1 (2.6%) had LVT, and the remaining 37 were absent for LVT. Out of a total of 15 cases of antero-inferior MI. 3 (20%) cases had LVT, and 13 had no LVT. The patients presented with other type groups of MI had no (0%) LVT out of 15 cases. (Table 4).

Table 4:- Distribution of MIs with LV Clot.

| | | LV Clot | | Total |
|-------------|--------------------|----------|-----------|-------|
| | | Present | Absent | |
| EKG_Finding | Extensive_ant_MI | 3 (23%) | 10 (76%) | 13 |
| | Anterolateral MI | 5 (20%) | 20 (80%) | 25 |
| | Anteroseptal MI | 6 (9.6%) | 56(90.3%) | 62 |
| | Inferior MI | 1 (2.6%) | 37(97.3%) | 38 |
| | Antero-inferior MI | 3 (20%) | 13 (80%) | 15 |
| | Others | 0 | 15 | 15 |
| Total | | 18 | 151 | 168 |

The frequency of LVT was higher in anterior infarcts than the others. Out of the total of 115 cases of anterior MI, 16 had LVT, and 99 were having no LVT, and other types of MI showed a reduced frequency of clot formation, i.e., In total 53 cases, only one individual had LV clot the remaining 53 were absent for clot. Hence, the frequency was higher in anterior infarcts. The total cases for LVT were 17 of which 16 (94.1%) were with anterior MI, and only 1 (5.9%) patient with LVT was with other types of MI.

The LVT was higher frequency in the setting of anterior MI, and the association of LVT and anterior MI is proved statistically significant ($p < 0.05$).

Discussion:-

CHD is the most important clinical and public health issue throughout the entire globe. Some researchers say that this disease is likely to become the most common cause of death globally until 2020. (1) The formation of LVT is one of the most common complications of MI. LVT is the most common source of embolic stroke after STEMI. (1) In our country, there is even a greater problem, where on one side, CHD is going on the rise, and on the other side, there is a lack of diagnosis in early stages and primary intervention (primary PCI/thrombolysis). There are still many health care centers that do not have these setups. This study included 168 subjects of diagnosed acute Myocardial Infarction, AMI. The distribution of male and female gender of this study matched with the local researches, among which Chaudhry et al. (1) matched the values of our study, in which 70% were males, and 30% were females. Rath et al. (1) demonstrated male dominance and showed 66.8% males and 33.2% females. Hafeez et al. (1)(10) and Jafary et al. (11) also showed a similar proportion of male preponderance.

In Hafeez et al., the mean age of the subjects was 58 ± 11 years, which was resembled this study, the mean age of subjects with MI in this study was 55.90 ± 8.99 years. The mean age in the Maqbool Jafary et al. (11) was 52 ± 10.8 . The mean age in the COURAGE trials(12), which was conducted in the USA, was 62 ± 5 years. This shows that the people of our country are younger than the people of the west, relatively. One of the recent studies in which the MI was compared between Caucasians and South Asians. The study demonstrated the Asians were ten years younger than Caucasians. (13) The LVT was found in 17 (10%) out of 168 subjects. The local and international data about the presence or absence of LVT shows different frequencies. The most acceptable and best data for incidence is said to be the GISSI-3 database(14) of 8326 subjects, only 11.5% of MI patients developed LVT after MI. The frequency is closely related to our data. Another study by Porter et al. (15) found that 23.5% of patients who were suffering from AMI developed LVT. In contrast, a study was done by Okuyan et al. in turkey(16) demonstrated the Incidence of LVT as 42.8%. The lower percentage in the study of Porter may be due to early diagnosis and availability of early intervention, which was not studied in our research. Chaudhry et al. (1) and Wasim et al. (1) have conducted two different research, and the incidence in their study in anterior MI was 26.66%, which shows a huge difference relating to our study. In our study, the incidence was 94.1%. This difference may be due to the sample selection criteria because, in our study, we have selected every patient who presented with MI regardless of the type and age of MI. While Rathie and his colleagues, similar to our study, selected the patients of all types of MI and did not restricted their study to anterior MI and found that 17.8% of subjects developed LVT.(1) Their results were comparable to our study. Another studies conducted by Rehan et al(1)(17) and Karla et al(18) found the prevalence of 11% and 10% respectively which were also similar to our study.

The Incidence of anterior MI in our study was 7.7%, which was slightly higher than 5.6% of frequency from the study of Kambery et al., who studied the subjects after the PCI. (1) The increased incidence in our study may be due to the non-selection of PCI subjects as we didn't include the PCI subjects. In non PCI subjects, the frequency was 44.4% in Kambery's study.

The occurrence of LVT was higher, 35.8%, in the age group more than 50 years in the study conducted by Jalal-ud-din et al. (1). Compare to our study; the frequency was much higher in the age group > 50 years; the occurrence was 70%. This gap may be due to the exclusion of NSTEMI patients from our study; in contrast, Rathie et al. and Chaudhry et al., there was no variance in mean ages in those subjects who didn't develop LVT and those who did. A similar discovery was detected by Zelinska and his colleague(1)(19). Regarding the gender, Zelinsk(19) found the increase in the frequency of LVT in males, which was similar to the study conducted by Jalal-ud-din et al. 39.7% in males and 22.2% in female, but these results were not related to our study, as our study revealed female preponderance as 14% females and 8.5% males developed LVT. This dissimilarity in our study may be due to the increased ratio of males to females (118M:50F) and the exclusion of NSTEMI. Because Zelinska and Jalal-ud-din et al. included both STEMI and NSTEMI subjects, and they also mentioned the age of infarction in their studies, which was not included in our study.

Conclusion:-

After the study of literature, result investigation, and discussion, we have concluded that the frequency of myocardial infarction is higher in the male than female gender. After MI, the left ventricular thrombus (LVT) appeared to be the common complication, especially the population more than 50 years are at high risk for LVT compare to the population less than 50 years. So age has appeared to be a risk factor for LVT formation in MI patients. The population who have anterior MI had an increased frequency of LVT formation than those who had other types of MI. Echocardiography should be performed routinely in patients with acute MI to detect this life-threatening complication in the early stages and to treat it timely.

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