A prospective study of drug utilization pattern of cardiac inotropes in cardiac intensive care unit at a tertiary care hospital

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INTRODUCTION

Inotropic agents are medicines that change the force of contraction of the heart. Inotropes have been fundamental to the resuscitation of acute cardiogenic shocks for decades. Heart failure and cardiogenic shocks are caused by a reduction in the myocardial contractile force where inotropes can successfully increase the cardiac output. Inotropic therapy is frequently initiated to improve the ventricular functioning after cardiac surgeries.[1]

There are two types of inotropes: Positive inotropes and negative inotropes. Positive inotropes weaken the contraction of the heart, so it helps to pump more amount of blood with fewer heartbeats. Negative inotropes weaken the contraction of the heart and also slow down the heart rate. Positive inotropes are commonly given to patients with congestive heart failure or cardiomyopathy, recent heart attack due to coronary artery diseases (CAD), and patients whose heart has been weaken after a heart surgery. Negative inotropes are given to patients with high blood pressure, chronic heart failure, arrhythmias, and angina and in patients with heart attacks to reduce the stress on heart.

Cardiovascular diseases (CVD) have emerged as the leading cause of morbidity and mortality throughout the world.[2] In recent years, the risk of CVD has increased in India also. The death rate due to CVD in India is higher than the global average.[3,4] Each

ABSTRACT

Background and Objective: Inotropes have been fundamental for the resuscitation of acute cardiogenic shock for decades. There are two types of inotropes: Positive inotrope and negative inotrope. Positive inotrope increases the force of contraction of the heart, and negative inotrope weakens the heart beats. There is a marked difference in the usage pattern of inotrope in the treatment of hospitalized patients for various cardiovascular diseases. The main of the study was to analyze the prescribing patterns of cardiac inotropes in the cardiac intensive care unit (CTICU). Materials and Methods: The prospective observational study was carried out for the duration of 6 months in the department of CTICU at a tertiary hospital, Chennai. A total of 91 patients were selected for the study. Patient case sheets (including patient demographic details, drug therapy, and laboratory investigations) were used to extract the necessary data. The percentage of data was calculated with the help of Microsoft Excel sheet, and the sample size was calculated using the formula. Results: Of the 91 patients enrolled in the study, majority were male (67) and were found in the age group of 51–60 years. Adrenaline 50 (54.95%) was most commonly prescribed positive inotrope, followed by noradrenaline 37 (40.66%) and dobutamine 35 (38.46%). Amiodarone 18 (19.78%) was most commonly prescribed negative inotropes, followed by propranolol 5 (5.59%) and nicorandil 3 (3.30%). The mean duration of stay in the hospital was 7.42 days. The average number of inotropes prescribed per prescription was 1.71. The average number of drugs prescribed per prescription was 13.34. Conclusion: Positive inotropes were the most frequently prescribed drug. Mean number of drugs per prescription were high. The prescribing pattern could be improved by reducing number of drugs in prescription and varies in between positive and negative inotropes to a greater extent.

KEY WORDS: Drug utilization, Inotropes, Medications

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Rheumatic heart disease (RHD) is characterized by damage to one or more heart valves. Even though there is a slight decline in the occurrence of RHD, it remains to be a common health problem in the developing countries which contributes to morbidity and mortality in both children and adult population.\(^5\)

Cardiomyopathies are of different types, but they are commonly characterized by the structural and functional abnormalities of the myocardium. The American Heart Association has proposed a definition and classification for cardiomyopathies in 2006 which says that cardiomyopathies are a heterogeneous group of diseases of the myocardium associated with mechanical and/or electrical dysfunction which usually (but invariably) exhibit inappropriate ventricular hypertrophy or dilatation and are due to a variety of causes that frequently are genetic. Cardiomyopathies either are confined to the heart or are part of generalized systemic disorders, which may lead to cardiovascular death or progressive heart failure-related disability.\(^7\)

People with type II DM are at high risk of CVD which leads to increased morbidity and mortality while comparing to the people without diabetes.\(^6\) Micro- and macro-vascular complications associated with diabetes were responsible for 2–3-fold increase in the risk of heart failure and 2–4-fold increase in the risk of CAD. Increased blood pressure often causes abnormalities to the cardiac structure and function. It includes left ventricular hypertrophy, systolic and diastolic dysfunction which further leads to cardiac failure.\(^8\) It is a well-known fact that cardiac diseases are always caused by an association of various contributing factors such as diabetes and hypertension.

Many drug utilization studies have been conducted on specific populations with various study settings in India.\(^10\)\(^-\)\(^12\) However only few studies have been conducted in emergency settings.\(^10,13\)\(^-\)\(^15\) Cardiac unit was an excellent platforms for conducting the study on the usage pattern of cardiac inotropes as the uses of these drugs are quite extensive in this department.\(^10\) Utilization pattern of cardiac inotropes can be used to estimate the number of patients exposed to different inotropes within a given time period. This can also be used to estimate the proper utilization of inotropic agents. The study on usage pattern in turns serves as an important tool to determine rational drug therapy.

At present, there were only limited data to guide practice patterns and evidence-based use of inotropes in cardiac surgery.\(^11\) Drug utilization pattern of cardiac inotropes in the cardiac unit of a hospital can be the part of a continuous evaluation program when the patterns are followed over time and trends in drug use can be discerned, and it can be used to determine the extent to which alternative drugs are being used in particular conditions. The objective of the current study was to focus on the usage pattern of cardiac inotropes in the cardiac intensive care unit (CTICU).

### MATERIALS AND METHODS

#### Study Design and Place of Research

A prospective observational study was carried out in the CTICU of a tertiary care hospital located at Chennai. A total of 91 participants were enrolled in the study from the CTICU of the hospital from January to June 2016.

#### Inclusion Criteria

Case records of patients above the age of 18 years who are receiving inotropic therapy in the 2 CTICU and only in-patients were included in the study.

#### Exclusion Criteria

Children under the age of 18 years, pregnant and lactating mothers, and psychiatric illness were excluded from the study.

#### Methodology

Information regarding the patient demographics and inotropic therapy were collected in detail and documented in the specially designed format. Data collection form includes:

- Patient demographic details such as age, gender, and other details.
- Category-wise distribution according to diagnosis.
- Details of the prescribed inotropes for the patients in the CTICU.

#### Statistical Analysis

The data were entered into the Microsoft Excel sheet, and the results were expressed in percentage frequency. The analysis was performed by SPSS version 21 and \(P < 0.05\) which is statistically significant.

### RESULTS

Among 91 patients participated, 67 (73.63\%) were male and 24 (26.37\%) were female. In most of the age groups, male patients were found to be affected with different heart diseases while comparing to female patients [Figure 1]. Occurrence of heart disease among male and female patients was found to be equal in the age group of 31–40 years. In contrast to all other age groups, a number of female patients were higher in the age group of 21–30 years.

A majority of the total population was diagnosed with CAD-triple vessel disease (TVD) (45.05\%), followed...
by RHD (18.68%), DCM/RCM (10.99%), CAD-DVD (7.69%), and other cardiac diseases (7.69%) [Table 1].

Of 91 patients, 63.74% were found to have diabetes, 51.65% have hypertension, and each 1.1% has asthma and hyperlipidemia.

Among the total population, 57.14% of patients stayed in the hospital for a duration of 6–10 days, followed by 27.47% of patients stayed for ≤5 days and 10.98% of patients stayed for 11–15 days [Figure 2].

Of 91 patients, 54.95% of patients were treated with adrenaline, 40.66% of patients with noradrenaline, 9.89% of patients with milrinone, 10.99% of patients with dopamine, and 38.46% of patients with dobutamine [Table 2]. Amiodarone was the most frequently used negative inotrope which is used in 19.78% of the study population, followed by propranolol in 5.49% and nicorandil in 3.3%.

DISCUSSION

The present study was to evaluate the usage pattern of cardiac inotropes in the CTICU at a tertiary care hospital. A total of 91 case records were analyzed during the 6 months’ time period. Results indicated that the frequency of cardiac diseases was more in male patients (73.63%) than the female patients (26.37%) which is in accordance with the study conducted by Al-Junid et al. In contrast to the study conducted by Vakade et al., a number of male and female patients were found to be equal in the age group of 21–30 years and these patients were commonly diagnosed with valvular diseases and cardiomyopathies. Over the age of 40 years, male patients were found to be predominantly affected with cardiac diseases.

According to the projections of the National Commission and Macroeconomics and Health, Government of India, the total number of CAD patients in India at the turn of the century was 30 million (5.3% of adult population). More than half of the study population (54.94% of patients) was diagnosed with different types of CAD in that TVD.
predominates more (45.05% of the total population). 18.68% of the study population was found to be affected with RHD which is still present in 80% of the world countries as an important long-term sequel of rheumatic fever.[18]

In our study, we noticed that major comorbidities present in the patient population were diabetes and hypertension. Diabetes was found in 64.74% of the patients and hypertension was found in 51.65% of the patients. The association between diabetes and macrovascular complications is well known, and high blood pressure has long been recognized as a major risk factor for CVD. 35.16% of the patients were found to have both diabetes and hypertension. The combination of diabetes and hypertension increases the overall risk of cardiovascular diseases. This finding is in accordance with the results of the study conducted by Lip et al.[9]

The pattern of inotropic usage varies to a greater extent in between and among the cardiac inotropes. The variability in the treatment choice is based on the changes in the clinical evidences, and similarly, the other study done by Partovian et al. also showed a marked difference in the use of inotropic agents for heart failure patients.[20]

After the cardiothoracic surgeries, most frequently used positive inotropes were found to be adrenaline followed by noradrenaline and dobutamine. This result is contrast to the study done by Nagabushan et al. where the most frequently used positive inotrope was dopamine.[21] Amiodarone was found to be the frequently used negative inotropes (19.78%).

The present study has several limitations to consider. First, we have listed only five major positive intravenous inotropes in the study. We are not able to provide information on the use of other inotropic agents secondly, and the analysis of inotrope usage was done at the hospital level, whereas the decision for inotrope use is mainly physician driven. We did not have data on the prescriptions at the physician level.

REFERENCES