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Original article

Patterns and determinants of cardiovascular drug utilization in coronary care unit patients of a tertiary care hospital

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ABSTRACT

Background: A wide variation exists in the patterns of pharmacotherapy among patients admitted with cardiovascular diseases. Very few studies have evaluated the potential determinants of drug utilization. Our objective was to evaluate the clinical characteristics and patterns of cardiovascular drug utilization among patients in coronary care unit (CCU) and assess the determinants of cardiovascular drug use among patients with coronary artery disease (CAD).

Methods: In this retrospective cohort study, the medical records of CCU patients were reviewed independently by two trained physicians over one year. Patients were analyzed as two groups – those with CAD and without CAD. Multivariate logistic regression was done to identify the determinants of cardiovascular drug utilization in the CAD group.

Results: Of 574 patients, 65% were males, 57% were <60 years. The five commonly prescribed drug classes were platelet inhibitors (88.7%), statins (76.3%), ACE-inhibitors/Angiotensin receptor blockers (72%), beta-blockers (58%) and heparin (57%). Poly-pharmacy (>5 drugs) was noticed in 71% of patients. A majority of patients had diagnosis of CAD (72.6%). CAD patients received significantly higher median number of drugs and had longer duration of CCU stay ($p < 0.0001$). Renal dysfunction for ACE-inhibitors [0.18 (0.09–0.36)], ST-elevation myocardial infarction for calcium channel blockers [0.29 (0.09–0.93)] and brady-arrhythmias for beta-blockers [0.3 (0.2–0.7)] were identified as determinants of decreased drug use in CAD group.

Conclusion: Predominance of male gender, age <60 and poly-pharmacy was observed in CCU. Antithrombotics, statins, ACE-inhibitors/Angiotensin receptor blockers and beta-blockers were the most frequently prescribed drugs. Clinical co-morbidities (renal dysfunction, arrhythmias) decreased the utilization of ACE-inhibitors, beta-blockers among CAD patients.

1. Introduction

Cardiovascular diseases (CVDs) have emerged as the leading cause of mortality with developing countries accounting for 80% of cardiovascular deaths.[1] The mortality data from first phase of the Million Death Study showed CVDs as the largest cause of deaths in India leading to 1.7–2 million deaths annually.[2]

According to the Global burden of diseases study in India, coronary artery disease is the largest contributor to CVD accounting for over 35% of disease burden.[3,4] As per predictions from studies by the National Commission for Macroeconomics and Health, Government of India, the number of patients with CAD is set to increase over 60 million by 2015.[5]

Drug therapies in critically ill patients are often complicated by the altered physiology and coexistence of multiple co-morbidities that warrants polypharmacy. Polypharmacy may increase the risk of adverse drug reactions (ADRs), medication errors and patient non-compliance with treatment.[6]

The American College of Cardiology Federation/American Heart Association (ACCF/AHA) guidelines – 2011 have recommended pharmacotherapy with anti-thrombotics, Angiotensin Converting Enzyme (ACE) inhibitors, Angiotensin Receptor Blockers (ARBs) and beta-blockers based on results of multiple controlled trials to improve survival benefits in Acute Coronary Syndrome (ACS).[7–10] In spite of availability of standard guidelines, a wide variation exists in patterns of pharmacotherapy. An observational study which evaluated treatment practices for acute myocardial infarction (MI)

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across hospitals in South India observed appropriate use of thrombolytics, beta-blockers and ACE-inhibitors among 83%, 78% and 99.3% of patients respectively.[11] Only 40% of ACS patients received combined beta-blockers, statins and ACE-inhibitors in an Estonian study.[12]

Very few studies have evaluated factors that predict the utilization of pharmacotherapy in patients with cardiovascular diseases. Assiri et al[13] has reported that presence of diabetes predicts use of ACE-inhibitors [Adjusted Odds Ratio (aOR) = 1.496 (1.055–2.121)], whereas the diagnosis of unstable angina [aOR = 9.803 (1.312–71.42)] and ST-elevation MI (STEMI) [aOR = 8.064 (1.052–62.5)] predicted use of statins. Assessment of drug utilization patterns and potential determinants of utilization are highly essential to establish the optimal utilization of evidence-based therapies.

The objectives of this study were to evaluate the demographics, clinical characteristics and patterns of cardiovascular drug utilization among patients admitted to CCU and assess the potential determinants of utilization of cardiovascular drug classes among patients with CAD.

2. Methods and materials

2.1. Study setting, design and data collection

This was a retrospective cohort study conducted in CCU of St John's Medical College, Bangalore, India, which is a 1500 bed tertiary care teaching hospital. The study method and results on patterns, predictors and preventability of adverse drug reactions in the CCU of a tertiary hospital have been reported in our earlier paper.[14]

The case records of 574 consecutive patients admitted to CCU between 1st January 2008 and 31st December 2008 were retrospectively reviewed by two trained physicians independently. All patients admitted and treated for more than 24 h were included in the study. Data on demographics, clinical characteristics and drug prescription were collected in a specially designed case record form. Patients with missing details on relevant drug utilization data were excluded from analysis. Institutional Ethical Review Board (IERB) approved conduct of the study.

Drugs were classified based on WHO's Anatomic Therapeutic Chemical Classification System.[15] They were divided into groups based on organ system (1st level), therapeutic and chemical characteristics (2nd, 3rd, 4th levels). The total number of drugs and cardiovascular drugs prescribed per person was noted. Among the cardiovascular drugs prescribed, those from the WHO Essential Drug list were noted.[16]

The patient population was considered as two groups: those with diagnosis of CAD and those without CAD (Non-CAD group). The diagnoses were defined based on clinical presentation, definite ECG changes, Echocardiography/angiography findings and other investigation values using International Classification of Diseases version-10 (ICD-10).[17] Renal dysfunction was defined based on the estimated creatinine clearance (ml/min) values calculated using the Cockcroft–Gault equation. Baseline characteristics, co-morbidities and treatment patterns were compared across both groups. The characteristics of CAD patients were analyzed to identify potential factors affecting utilization of cardiovascular drug classes.

2.2. Statistical analysis

Descriptive measures (mean ± SD, median, inter-quartile range) were used to summarize numerical variables. For categorical variables, percentages were used. Chi-square test, Unpaired-*t* test and Mann–Whitney *U* test were used to analyze differences in baseline characteristics between CAD and non-CAD group. Multivariate logistic regression was used to identify the determinants of drug utilization among patients with CAD. Univariate analyses were done with set of eleven independent variables and nine cardiovascular drug classes. The variables considered for the first step of regression analysis included demographic data (gender and age) and clinical co-morbidities [hypertension, diabetes mellitus, STEMI, NSTEMI, unstable angina, ischemic heart disease (IHD), congestive cardiac failure (CCF), renal dysfunction and arrhythmias]. Binary logistic regression was done with independent variables found significant in the univariate analysis ($p < 0.2$) to identify potential factors affecting utilization of adjunctive pharmacotherapy among CAD patients. The data were entered and analyzed in SPSS version-20 software. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Demographic and clinical characteristics

During the study period, a total of 574 consecutive patients were admitted to CCU. 417 (72.6%) had a diagnosis of CAD (CAD group) and 157 (27.3%) were hospitalized for conditions other than CAD (Non-CAD group). Majority were males (65.1%) and were <60 years (57.1%). Patients in CAD group were older (60 vs 50.5; $p < 0.0001$), had a significantly longer median duration of CCU stay [3 (2–3) vs. 2 (2–3); $p < 0.0001$] and received significantly higher median

Table 1
Baseline characteristics of patients with CAD and non-CAD.

Variables	Overall $N = 574$ (100%)	CAD (417; 72.6%)	Non-CAD (157; 27.3%)	*p*-Value*
Gender[a]; *n* (%)				0.768
•Males	374 (65.1)	274 (65.7)	100 (63.6)	
•Females	200 (34.8)	143 (34.2)	57 (36.3)	
Age; Mean (±SD)[b]	57.39 (15.1)	60.00 (13.4)	50.52 (17.0)	<0.0001
<60[a]	328 (57.1)	216 (51.8)	112 (71.3)	
>60[a]	246 (42.9)	201 (48.2)	45 (28.7)	<0.0001
Median hospital stay (days)[c]	6 (4–10)	6 (4–11)	6 (4–10)	0.052
Median CCU stay (days)[c]	3 (2–3)	3 (2–3)	2 (2–3)	<0.0001
Median no. of drugs[c]	10 (8–10)	10 (9–12)	8 (6–10)	<0.0001
Median no. of cardiovascular drugs[c]	7 (5–7)	7 (6–9)	5 (4–6.5)	<0.0001
Median no. of comorbidities	3 (2–4)	3 (2–4)	2 (1–3)	<0.0001

Abbreviations: CAD (Coronary Artery Disease); Non-CAD (Non Coronary Artery disease); CCU (Coronary Care Unit).
* – $p < 0.05$ is considered statistically significant.
Data are given as:
[a] Number (*n*) of patients with percentages (%) in parentheses or as,
[b] Mean ± standard deviation or as,
[c] Median with interquartile range in parentheses.