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## Original Research Article

# A study on drug utilization pattern of anticoagulants in post-cardiac surgeries at a tertiary care hospital

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## ABSTRACT

**Background:** The study is being carried out mainly to understand the prevention of coagulation of blood after a patient undergoing various types of cardiac surgeries, using different anticoagulation therapies suitable to particular types of cardiac surgery. This study was conducted to know the types of anticoagulants prescribed to patients who have undergone different types of cardiac surgeries along with the prescribed anticoagulants.

**Methods:** The study method used was a retrospective and prospective observational study carried out on 50 patients who underwent cardiac surgeries in the department of cardiology and medicine.

**Results:** A total of 50 patients were enrolled for this study who satisfied the inclusion criteria, out of which 64% of patients were males, and 36% were females. The highest number of patients were found to be in between the age group of 61-70 yrs (34%), whereas age group between 51-60 yrs (28%), age group 71 and above (18%), 41-50 (14%), 21-30 yrs (4%) and 18-20 yrs (2%) respectively. Most of the patients had undergone Coronary Artery bypass grafting. It was seen that the highest Anticoagulant being prescribed was Heparin in most of the post-cardiac surgeries. Whereas drugs like dalteparin, acenocoumarol, and warfarin were prescribed the majority in valvular heart surgeries.

**Conclusions:** Various cardiac surgeries were taken into consideration for the study. The most common anticoagulants prescribed were heparin, dalteparin, acenocoumarol, and warfarin in coronary artery bypass surgery and valvular heart surgeries respectively.

**Keywords:** Drug utilization pattern, Anticoagulants, Cardiac surgeries, Heparin, Warfarin, Valvular heart surgeries

## INTRODUCTION

Drug Utilization pattern is considered a powerful tool to assess the health care system that involves marketing, distribution, prescription, and use of drugs in society with special emphasis on the resulting medical, social, and economic consequences.<sup>1</sup> Drug Utilization pattern explains the extent and profiles of drug use and it also helps in estimating a number of patients exposed to drugs in a given period, estimating the extent of drug use in certain situations, and assessing drug-related problems like

adverse drug reactions or drug interactions. Drug utilization patterns differ from physician to physician and from patient to patient. This study aims to understand the drug utilization pattern of anticoagulants in post-cardiac surgeries, to identify the number of patients administered with a particular type of anticoagulant after a particular type of cardiac surgery within a given period, and to study the drug profile including generic name, brand name, dose, frequency, duration, route of administration and to identify which is the most commonly used anticoagulant by different prescribers.<sup>2,3</sup> One of the most common surgeries seen in patients undergoing are cardiac surgeries and the

type of surgery varies from patient to patient and the age group they belong. Cardiac surgery is the specialty of medicine concerning the surgical treatment of pathologies related to the heart and thoracic aorta. The modern cardiac surgery can be understood by its history beginning at the end of the 19th century.<sup>4</sup> There are various types of cardiac surgeries such as coronary artery bypass grafting (CABG), heart valve surgery, bental procedure, atrial septal defect closure, etc. heart valve surgery which includes both AVR (aortic valve replacement) and MVR (mitral valve repair) and sometimes double valve repair. The patients after undergoing cardiac surgeries are exposed to a higher risk for various post-surgery complications. The major complications are blood coagulation, bleeding, atrial fibrillation, stroke, myocardial infarction, and arrhythmia. Atrial fibrillation (AF) is the most common complication after cardiac surgery (CS) and it is the most common rhythm disturbance following coronary bypass surgery.<sup>5</sup> In recent studies, it is said that postoperative AF occurred in 25% to 40% of patients undergoing coronary artery bypass graft surgery and in 60% of patients undergoing valvular surgery.<sup>6</sup> AF occurs most often on postoperative days even though most AF episodes (75% to 80%) occur during hospitalization, AF occurring soon after discharge is a common reason for hospital readmission.<sup>7</sup>

Although postoperative AF is often self-limiting and is not associated with increased mortality, an irregular and rapid ventricular rate and the absence of organized atrial activity may result in hypotension and congestive heart failure, as well as uncomfortable symptoms. AF after heart surgery is associated with increased hospital costs and length of stay. Post-operative atrial fibrillation remains a serious medical concern and poses serious risks to patients in the postoperative period hence requiring preventive healthcare measures.<sup>8</sup> Stroke is also a major complication seen in patients undergoing cardiac surgeries.<sup>9</sup> 2 types of strokes have different pathophysiologic mechanisms; one is the early or intraoperative stroke and the other is the delayed or postoperative stroke. Intraoperative stroke occurs primarily from aortic manipulation and aeroembolism, whereas delayed or postoperative stroke is usually related to postoperative atrial fibrillation or cerebral vascular disease.<sup>10</sup> The risk of developing a perioperative stroke is higher with patients undergoing cardiac surgery than with nonvascular surgery. The reported risk of perioperative stroke is 1.2% for CABG, 1.5% for aortic valve replacement, and 2.1% for mitral valve replacement surgery.<sup>11,12</sup> A study was conducted among 388 patients who underwent CABG surgery, in which embolic strokes were noted in 62% patients, followed by stroke due to unknown etiology in 13.9%, strokes due to multiple etiologies in 10.1%, and due to hyperfusion in 8.8% patients, lacunar stroke in 3.1%, thrombotic in 1.0% and hemorrhagic strokes in 1% of patients.<sup>13</sup> Stroke is the most serious complication of CABG surgery. There is an unexplained peak risk of stroke after CABG around postoperative day two. The inflammatory process and hypercoagulability after surgery are responsible for this peak hence, to prevent this complication and other

complications anticoagulant treatment is necessary and is effective for the prevention and management of postoperative complications.<sup>14</sup>

The conditions where coagulation gets prolonged and leads to the thickening of blood in the body which is followed by clot formation which can be dangerous as the clot can travel to different blood vessels and block them by stopping the blood flow further. The conditions like deep vein thrombosis, pulmonary embolism, and clot formation after surgeries like hip replacement, valvular heart surgeries, etc. there are high risk of clot formation, and the treatment for such conditions is done by administration of Anticoagulant drugs. For example Heparin, Low molecular weight heparin, Warfarin, etc. Anticoagulants are the drugs which are usually referred to as blood thinners, they are chemical substances that prevent or reduce coagulation of blood by prolonging the clotting time. These are prescribed in clinical settings to treat hospitalized patients like acute and deep venous thromboembolism [DVT], unstable angina, atrial fibrillation and to prevent coronary arteries from blockage. Anticoagulant therapy is a part of the management of patients undergoing cardiac surgery.<sup>15</sup>

### ***Importance of the study***

The study of “drug utilization pattern of anticoagulants in post-cardiac surgeries” was taken up to know the types of anticoagulants prescribed to patients who have undergone different types of cardiac surgeries along with which the prescribed anticoagulants were also studied for their dose, duration, frequency, route of administration, INR levels, PT levels among patients. This study also focuses on several males and females undergone particular types of surgery. It also helps to identify which is the most commonly used anticoagulant by different prescribers. It can also be used as feedback for the prescribers. Anticoagulation therapy is a key part management of patients undergoing cardiac surgery and is one of the cornerstones to prevent complications after cardiac surgery. The use of anticoagulants is lifesaving.

## **METHODS**

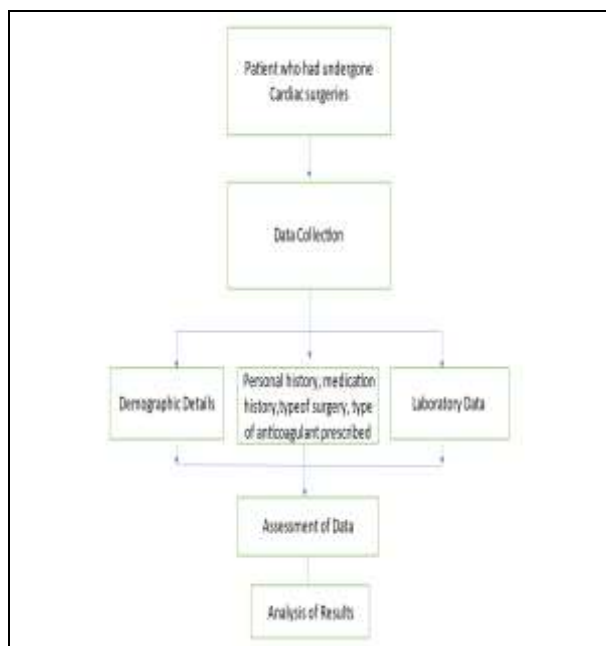
### ***Study design, population, location and duration***

It is a retrospective and prospective observational study conducted in a tertiary care hospital. A total of 50 patients who underwent cardiac surgeries were enrolled in the study. The study was conducted at Bangalore Baptist Hospital from January 2022 to October 2022.

### ***Inclusion criteria***

Patients who are above 18 years of age were selected. Patients who underwent different cardiac surgeries such as coronary artery bypass grafting, Valvular heart surgeries such as AVR (Aortic valve replacement), MVR (Mitral valve replacement), DVR (Double valve replacement)

were chosen and patient with atrial fibrillation after cardiac surgery were included in the study.



**Figure 1: Methodology.**

**Exclusion criteria**

Patients with pre-existing stroke before surgery and Pre-existing allergy to study drugs and patients with post-operative bleeding due to other reasons were excluded in the study.

**Source of data and materials**

Data from patient’s case sheets, treatment charts, Prescriptions, medication history charts and laboratory reports was taken and analysed.

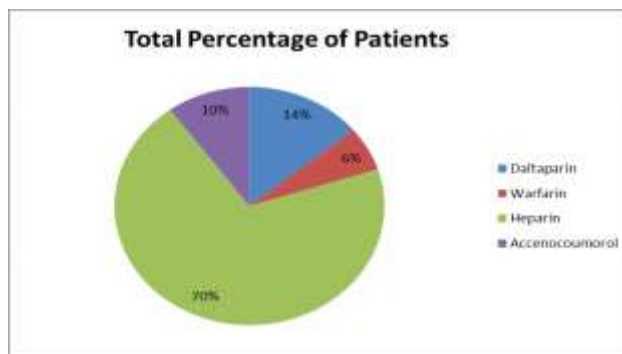
The study is being carried out on patients who have undergone cardiac surgeries and are being administered Anticoagulants. A sample of 50 patients is being assessed and enrolled in the study. All adult patients (above 18 years) are included in the study according to inclusion criteria. A retrospective and prospective observational study will be conducted in the department of cardiology and medicine. The patients who meet the criteria will be enrolled in the study. The data is which is collected includes details such as Patient demographics, Medical and medication history, Age, gender, history, reason for admission, type of cardiac surgery, type of anticoagulant prescribed, dose, frequency, route of administration of anticoagulants, and laboratory data. After collection of the data, the details are collected. The lab reports at the time are being recorded. then the data is analyzed to check which type of cardiac surgery the patient had undergone, what the type of anticoagulant prescribed, its dose, frequency, route of administration, and duration along with the INR range was analysed and reported.

**RESULTS**

A total of 50 patients were included in the study, of which 32 were male patients, and 18 were female patients which contributed to 64% and 36% respectively.

**Table 1: Patient Demographic detailed classification (n=50).**

Criteria	Category	N	%
<b>Gender</b>	Male	32	64
	Female	18	36
<b>Age group (years)</b>	18-20	1	2
	21-30	2	4
	31-40	0	0
	41-50	7	14
	51-60	14	28
	61-70	17	34
	71 & above	9	18
<b>Type of surgery</b>	CABG	32	64
	AVR	15	30
	MVR	01	2
	DVR	01	2
	CABG+AVR	01	2



**Figure 2: Represents the percentage of patients prescribed with different anticoagulants.**

It represents the number of male patients and female patients and the percentage of males and females involved in the study and with the majority of patients belonging to the age group 61-70 years having a total of 17 patients, followed by 51-60 years having 14 patients, the age group 71 and above had 9 patients, and age group 21-30 years had 2 patients. About 50 patients were enrolled in the study which majority of patients underwent CABG having a total of 32 patients, followed by AVR having a total of 15 patients, other 3 groups i.e MVR, DVR, CABG+AVR had 1 patient in each group underwent different types of cardiac surgeries (Table 1). The total number of patients prescribed with different types of anticoagulants, the most commonly prescribed anticoagulant was heparin having a total of 35 patients (i.e., 70%), followed by 7 patients were prescribed with Dalteparin (14%), 3 patients prescribed with warfarin (6%) and 5 patients with Acenocoumarol (10%) respectively (Figure 2).

**Table 3: Surgery CABG.**

Anticoagulant	Dose	Duration	Frequency	ROA	N	%
<b>Dalteparin</b>	5000 IU	4 days	OD	S/C	1	3.1
<b>Heparin</b>	5000 IU	5 days	TIDY	IV	3	9.3
	5000 IU	4 days	TIDY	IV	8	25
		3 days	TIDY	IV	2	6.15
	5000 IU	6 days	TIDY	IV	4	12.5
		5 days	TD	S/C	1	3.1
	5000 IU	5 days	BD	S/C	1	3.1
	2500 IU	4 days	TIDY	S/C	1	3.1
	2500 IU	4 days	BD	S/C	1	3.1
<b>Warfarin-heparin</b>	3 mg-5000 IU	4 days	TIDY	PO-IV	2	6.15
	3 mg- 5000 IU	4 days	BD	PO-IV	1	3.1
	5 mg- 5000 IU	5 days	TID	PO-S/C	1	3.1
		5 days	OD-BD	PO-S/C	1	3.1
	4 mg-2500 IU	4 days	OD-BD	PO-S/C	1	3.1
<b>Warfarin-dalteparin</b>	4 mg-2500 IU	5 days	OD-BD	PO-S/C	1	3.1
	4 mg-2500 IU	3 days	OD-BD	PO-S/C	1	3.1
	3 mg, 2500 IU	5 days	OD-BD	PO-S/C	2	6.15

**Table 4: Surgery MVR.**

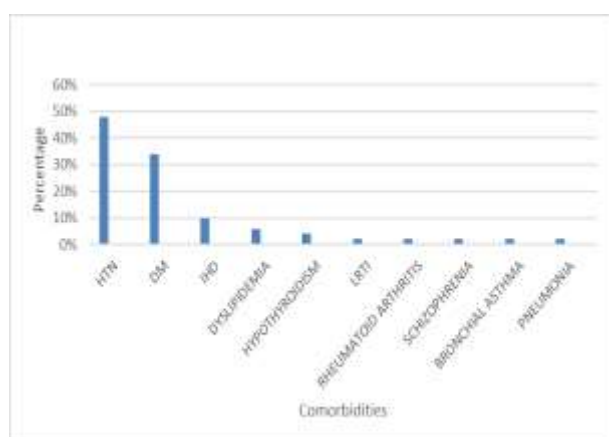
Anticoagulant	Dose	Duration	Frequency	ROA	N	%
<b>Acenocoumarol</b>	3 mg	Lifelong	OD	P/O	1	100

**Table 5: Surgery CABG+AVR.**

Anticoagulant	Dose	Duration	Frequency	ROA	N	%
<b>Acenocoumarol</b>	3 mg	Lifelong	OD	P/O	1	100

**Table 6: Surgery DVR.**

Anticoagulant	Dose	Duration	Frequency	ROA	N	%
<b>Acenocoumarol</b>	3 mg	Lifelong	OD	P/O	1	100



**Figure 3: Distribution of comorbidities in the study population.**

The total percentage of patients taking the type of anticoagulants with their different doses, duration, frequency, and different route of administration in AVR surgery, in which the most commonly used anticoagulant

was warfarin having a total of 3 patients of doses 1 mg, 2 mg, 4 mg for lifelong, once daily with 20% of the total population, 1 patient with 1mg of dose with 6.6% (Table 2). The total percentage of patients taking a type of anticoagulant with different doses, duration, frequency, and different routes of administration in CABG surgery (Table 3). The number of patients who had undergone Mitral valve replacement and the type of anticoagulant prescribed with its dose, frequency, and route of administration, in which Acenocoumarol with a dose of 3mg was prescribed once daily for lifelong (Table 4).

In the study, 1 of 50 patients underwent CABG+AVR surgery, in which Acenocoumarol anticoagulant of dose 3 mg was given for lifelong, once daily (Table 5). The number of patients who underwent DVR surgery, in which one patient who underwent DVR surgery was prescribed Acenocoumarol with a 3mg dose for life, once daily (Table 6). 24 out of 50 patients had hypertension, followed by DM (17), followed by Dyslipidaemia (3), 5 patients had a diagnosis as IHD, 2 patients had Hypothyroidism and various diseases such as LRTI, Rheumatoid arthritis,



Schizophrenia, Bronchial asthma, Pneumonia was in 1 in each patient (Figure 3). It represents the INR range maintained in different types of cardiac surgeries (Table 7).

**Table 7: INR Range maintained after different cardiac surgeries.**

Type of surgery	INR range
AVR (mechanical valve)	2-3
AVR (bioprosthetic valve)	2-2.5
DVR	2-2.5
MVR	2.3-3.5
CABG (when prescribed with warfarin)	2-3
CABG (when prescribed with Heparin)	2-2.5

## DISCUSSION

The study aimed to study the drug utilization pattern of anticoagulants in post-cardiac surgeries. In a total of 50 patients, analysis of age, gender, type of cardiac surgery undergone, type of anticoagulant prescribed, and other comorbidities was performed. The patient distribution according to gender is evidenced in (Table 1).

A total of 50 patients were enrolled for this study who satisfied the inclusion criteria, out of which 64% of patients were males and 36% were females. The (Table 2) shows the distribution of patients based on their age groups. The age of the patients selected for the study was starting from 18 years of age. The age groups were further classified into seven groups, where 2% of patients belonged to 18-20 years age group, 4% of patients were in 21-30 years age group, 0% patients belonged to 31-40 years age group, 14% of patients were in 41-50 years age group, 28% of patients were in 51-60 years age group, 34% of patients belonged to 61-70 years age group and 18% of patients were in 71 & above age group. The highest number of patients was found to be in between the age group of 61-70 yrs. In (Table 3), the distribution of cases based on the type of surgery is shown. Out of 50 cases, 64% of patients had undergone coronary artery bypass grafting, 30% of patients had undergone aortic valve replacement, 2% of patients were found to have undergone mitral valve replacement, 2% of patients had double valve replacement, and CABG+AVR was found to be 2% of the total population. It was seen that most of the patients had undergone coronary artery bypass grafting. The (Table 4) shows the anticoagulants prescribed. In 50 cases collected 14% of patients were prescribed with Dalteparin, 6% of patients were prescribed with Warfarin, 70% of patients were prescribed with Heparin, and 10% of patients with Acenocoumarol. It was seen that the highest number of anticoagulants being prescribed was Heparin. In a study conducted by Headet et al it has been concluded that the most common anticoagulant prescribed after Valvular Heart Surgery is Warfarin.<sup>16</sup> This is also evident from

(Table 5) in which it was seen that out of 50 patients who underwent AVR, 26.6% of patients in total were prescribed with warfarin, about 19.9% of patients were prescribed with Heparin, 19.8% of patients were prescribed with Acenocoumarol, 19.8% of patients with Acenocoumarol and Heparin and 13.2% of patients with Warfarin and Heparin. Chandalavada et al conducted a study on drug utilization evaluation and assessment of the economic burden of anticoagulants which concluded that the most commonly prescribed anticoagulant for CABG is Heparin.<sup>15</sup> The (Table 6) also provides the same evidence that out of a total of 33 patients who underwent CABG, 59.1% were prescribed Heparin 5000 IU, about 6.2% of patients were prescribed 2500IU of Heparin, 3.1% of patients were prescribed Dalteparin 5000 IU. Warfarin and heparin were prescribed in about 15.4% and 6.2% of patients were given Warfarin and Dalteparin.

Out of a total of 50 patients, one patient underwent MVR surgery in which 3 mg of Acenocoumarol was prescribed once daily for life. Out of 50 patients, only one patient had undergone CABG+AVR, and was prescribed with Acenocoumarol. Out of a total of 50 patients, one patient had undergone DVR and was prescribed Acenocoumarol. In this study most commonly, observed comorbidities were HTN (48%), DM (34%), IHD (10%) Dyslipidaemia (6%), Hypothyroidism (4%), LRTI (2%), Rheumatoid arthritis (2%), Schizophrenia (2%), Bronchial asthma (2%) and Pneumonia (2%). The (Table 7) shows the normal range of INR to be maintained for various cardiac surgeries were found to be: AVR (Mechanical Valve) with INR: 2-3, AVR (Bioprosthetic Valve) with INR range: 2-2.5, DVR with INR 2-2.5, MVR with INR: 2.5-3.3, CABG (if prescribed with warfarin) with INR range 2-3.

## Limitations

Limitations of the study were as it is an observational study it is difficult to define a sample size, patient involved provided meaningful insight into the current drug utilization practice but was not enough for comparing the other parameters such as the adverse reactions or events.

## CONCLUSION

The study was to know the drug utilization pattern of anticoagulants in post cardiac surgeries. 50 patients who underwent cardiac surgeries were enrolled for the study. From the study, it can be concluded that majority of the patients were males. As per the results most patients belonged to the age group 61-70 years and least patients belonged to the age group 31-40 years. Various cardiac surgeries were taken into consideration for the study where patients were prescribed with different anticoagulants, out of which most cases collected were of patients who underwent coronary by-pass grafting and comparatively fewer with valvular heart surgeries. The most common anticoagulants prescribed were heparin, dalteparin, acenocoumarol and warfarin in CABG and Valvular heart surgeries respectively.

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## REFERENCES

1. Shalini S, Ravichandran V, Mohanty BK, Saraswathi R, Dhanaraj SK. A study of drug utilization pattern at dental outpatient department. *Inter J Pharma Sci Nanotechnol.* 2010;3(1):803-10.
2. Pendhari SR, Chaudhari DR, Burute SR, Bite BM. A Study on the drug utilization trends in cardiovascular emergencies in a tertiary care hospital. *J Clin Diag Res.* 2013;(4):666-70.
3. Barot PA, Malhotra SD, Rana DA, Patel VJ, Patel KP. Drug utilization in emergency medicine department at a tertiary care teaching hospital: a prospective study. *J Basic Clin Pharma.* 2013;4(4):78-81.
4. Aris A. Francisco Romero, the first heart surgeon. *Ann Thorac Surg.* 1997;64(3):870-1.
5. Villareal RP, Hariharan R, Liu BC, Kar B, Lee VV, Elayda M. Postoperative atrial fibrillation and mortality after coronary artery bypass surgery. *J Am Coll Cardiol.* 2004;43(5):742-8.
6. Shrivastava R, Smith B, Caskey D, Reddy P. Atrial fibrillation after cardiac surgery: does prophylactic therapy decrease adverse outcomes associated with atrial fibrillation. *J Intensive Care Med.* 2009;24(1):18-25.
7. Almassi GH, Schowalter T, Nicolosi AC, Aggarwal A, Moritz TE, Henderson WG. Atrial fibrillation after cardiac surgery: a major morbid event? *Ann Surg.* 1997;226(4):501-11.
8. Mathew JP, Fontes ML, Tudor IC, Ramsay J, Duke P, Mazer CD. A multicenter risk index for atrial fibrillation after cardiac surgery. *JAMA.* 2004; 291(14):1720-9.
9. Whitlock R, Healey JS, Connolly SJ, Wang J, Danter MR, Tu JV. Predictors of early and late stroke following cardiac surgery. *CMAJ.* 2014;186(12):905-11.
10. Roach GW, Kanchuger M, Mangano CM, Newman M, Nussmeier N, Wolman R. Adverse cerebral outcomes after coronary bypass surgery. Multicenter Study of Perioperative Ischemia Research Group and the Ischemia Research and Education Foundation Investigators. *N Engl J Med.* 1996;335(25):1857-63.
11. Timm FP, Houle TT, Grabitz SD, Lihn AL, Stokholm JB, Eikermann-Haerter K. Migraine and risk of perioperative ischemic stroke and hospital readmission: hospital based registry study. *BMJ.* 2017; 356:6635.
12. O'Brien SM, Shahian DM, Filardo G, Ferraris VA, Haan CK, Rich JB. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2--isolated valve surgery. *Ann Thorac Surg.* 2009;88(1):S23-42.
13. Likosky DS, Marrin CA, Caplan LR, Baribeau YR, Morton JR, Weintraub RM. Determination of etiologic mechanisms of strokes secondary to coronary artery bypass graft surgery. *Stroke.* 2003;34(12):2830-4.
14. Tarakji KG, Sabik JF 3rd, Bhudia SK, Batizy LH, Blackstone EH. Temporal onset, risk factors, and outcomes associated with stroke after coronary artery bypass grafting. *JAMA.* 2011;305(4):381-90.
15. Chandalavada V, Gangula VNGM, Saikiran VVV, Medha GS. Drug Utilization Evaluation and Assessment of Economic Anticoagulants in a tertiary care hospital in south India. *J Pharma Sci Innovat.* 2018;(15):188-9.
16. Head JS, Bogers JJC, Kappetein AP. New Anticoagulants in Cardiac Surgery. *Int Cardiol Rev.* 2011;6(1):71-5.

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