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Original Research Article

Essential drug list for cardiovascular diseases in a tertiary health care centre

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ABSTRACT

Background: Essential medicines are those that satisfy the priority health care needs of a population. The latest version of NLEM is the 23rd list, published in September 2022, and contains 384 essential drugs, of which 29 are cardiovascular drugs. The drugs in the list may be huge or small according to the local needs. The objectives of our study are to prepare the essential drug list for cardiovascular disease in a tertiary care hospital and to confirm the essential drug list provided and its availability in the pharmacy.

Methods: We interviewed around 28 consultants from various departments who prescribe these cardiac drugs. The names, doses and dosage forms were noted. The list was verified with the NLEM 2022 and counterchecked in the hospital pharmacy.

Results: Most consultants adhered to NLEM, but an additional 42 drugs were prescribed, amounting to 71 drugs. There are four drugs Warfarin, Rivaroxaban, Furosemide and Torsemide which may be considered for the hospital pharmacy list.

Conclusions: Too many drugs other than those present in the NLEM list are prescribed, which can be reduced by adequately training the consultants to adhere to the prescribed list.

Keywords: NLEM, Cardiac drugs, Hospital pharmacy

INTRODUCTION

In the International conference on primary health care held in 1978, the Alma-Ata declared Health as a fundamental human right.¹ Thereafter, provision of the best possible health care services for society has gained a lot of importance worldwide.¹ The Alma Ata Declaration underscored the fact that primary health care was the key to making health for all a reality and identified several components of primary health care.² The provision of essential drugs was one of the components.² Medicines are integral parts of health care, and modern health care is

unthinkable without the availability of necessary medicines.³ They not only save lives and promote health but also prevent epidemics and disease.³

Essential medicines are those that satisfy the priority healthcare needs of a population.⁴ This concept was defined in 1975 by the World Health Organization (WHO) and is based on the premise that a limited list of carefully selected medicines will improve the quality of health care, provide cost-effective health care and better management of medicines.⁵ They are selected with due regard to disease prevalence and public health relevance, evidence of efficacy and safety and comparative cost-effectiveness.⁴

The scarcity of resources determines the priority to meet basic needs and improve the efficiency of resource use at all times.⁶ The Essential Drugs are intended to be available in functioning health systems at all times, in appropriate dosage forms, of assured quality and at prices individuals and health systems can afford.⁴ The concept of Essential Medicines has been accepted worldwide as a powerful tool for attaining of the highest possible level of health.⁷

In most low-income countries, pharmaceuticals are the largest public expenditure on health after personnel costs and the largest household health expenditure.⁸ Despite this substantial spending on drugs, lack of access to essential drugs, irrational use of drugs, and poor drug quality remain serious global public health problems.⁸ Selection of a limited number of essential medicines as essential, taking into consideration national disease burden and clinical need, can lead to improved access through streamlined procurement and distribution of quality-assured medicines, support more rational or appropriate prescribing and use and lower costs for both health care systems and for patients.⁴ The adoption of these priority tools into public policy could generate important savings by concentrating competition on a smaller number of medicines and better negotiating medication prices.⁹ In some settings, EMLs may drive medicine procurement decisions and in other settings, national insurers will use EMLs for reimbursement decisions.⁹

The WHO Model Lists of Essential Medicines are updated every two years.⁴ The first Essential Medicines List was published in 1977.⁴ The Model List of Essential medicines has evolved over the decades and has now taken into consideration other important variables, such as public relevance, efficacy, safety and value.¹⁰ The current version was updated in September 2021.⁴ The current list consists of 479 essential drugs in total, of which nineteen drugs in the core list, five drugs in the complimentary list and four fixed-dose combinations fall under the essential drugs for cardiovascular diseases.⁴ In 2007, a separate list for children up to 12 years was included.⁴ The current list is the 8th edition, released in September 2021.⁴

Similarly, the first National list of essential medicines of India was prepared and released in 1996.¹¹ This list contained 279 Essential Medicines.¹¹ The latest version of NLEM is the 23rd list, published in September 2022, and contains 384 essential drugs, of which 29 are cardiovascular drugs.¹² This is an increase from the 376 Essential Drugs present in the 2015 list, with 29 of them being cardiovascular drugs.¹³ An NLEM is supposed to respond to the health care priorities of each individual country as determined by the national burden of disease and national health care priorities.¹⁴ It is shown that essential medicines are more available than other medicines across Low- and Middle-income countries. Hence NLEMs indeed play a role in the supply of medicines (at least) in the public sector.¹⁴ An NLEM often constitutes a basis for district-level medicine lists and hospital formularies.¹⁴ In India, CVD is the leading cause

of mortality, with nearly 1.7 million deaths annually.¹⁵ The burden of CVD has increased in the past two decades and has shifted heavily to rural India because of population growth, aging and stable CVD mortality rate.¹⁵ The epidemic trend in CVD is likely to worsen due to poor risk factor control.¹⁵ The huge list of medicines published by WHO and NLEM for Cardiovascular Diseases may not be required considering the local disease prevalence. Hence, we wanted to prepare an essential drug list for cardiovascular disease for a tertiary care hospital as a pilot project. This will eliminate the wastage of resources in terms of manpower, money and space occupied for the storage of unnecessary drugs.

METHODS

It is a cross-sectional interview-based study involving faculties from the various departments of cardiology, general medicine, pediatrics, obstetrics and gynecology and intensive care unit. Prior approval from the ethics committee and informed consent from the participants were obtained. The study was conducted in hospital settings from April 2022 to October 2022. After explaining the purpose of the study, a one-on-one interview using the National List of Essential Medicines 2022 (Cardiovascular Section) as a reference was used to extract information. Details regarding the prevalent cardiovascular diseases in the hospital and the drugs prescribed for the same were collected. The prescribed drugs list for the prevailing conditions like ischemic heart disease, cardiac arrhythmias, hypertension, shock and heart failure, thrombolytics and anti-thrombotics, pulmonary hypertension and dyslipidemia were collected and checked for confirmation with the NLEM list. The data obtained were cross-verified with the hospital pharmacy for the availability (in stock) of originator brand (OB) and generic versions of the survey medicines. The data collected was entered into an Excel sheet for analysis using Epinfo version 7.0.

RESULTS

A one-on-one interview was conducted to identify the list of drugs prescribed for the cardiac condition using specific questions. A total of 28 consultants were involved in this study. The drugs prescribed by them were in different formulations. When analyzed for the drugs in a particular category without considering the formulations, we observed the following data. As shown in (Table 1), among the drugs prescribed for ischemic heart disease, only four drugs are on the list of NLEM and 2 drugs in the WHO list. It was observed that other than specified drugs, the majority were available in the pharmacy, while glyceryl trinitrate, which is in both the lists, was not available in the pharmacy. Similarly, for the drugs prescribed for cardiac arrhythmias, the NLEM list specifies six drugs, while the WHO list only mentions three drugs to be available in the pharmacy. There are six drugs that are not present in both the NLEM and WHO lists but are prescribed and available in the hospital pharmacy, as shown in (Table 2).

Table 1: List of drugs prescribed by consultants for the treatment of ischemic heart disease.

Generic Name	No. of consultants prescribed*	WHO EML 2021	NLEM 2022 (India)	Availability in Pharmacy
Diltiazem (Tab. 30 mg, Tab. 60 mg, MR Tab.180 mg, Inj. 5 mg/ml, SR Tab. 90 mg)	35		✓	✓
Glyceryl Trinitrate (Tab. 0.5 mg, Inj. 5 mg/ml)	23	✓	✓	
Isosorbide Dinitrate (Tab. 5 mg, Tab.10 mg)	24	✓	✓	✓
Isosorbide Mononitrate (Tab. 30 mg, Tab. 12.5 mg)	6			
Metoprolol (Tab. 25 mg, SR Tab. 25 mg, Tab. 50 mg, Tab. 100 mg, MR Tab.100 mg, Inj. 1 mg/ml, ER Tab. 12.5 mg, ER Tab. 25 mg, ER Tab. 50 mg, ER Tab. 100 mg)	63		✓	✓
Nicorandil (Tab.2.5 mg, Tab.5 mg, Inj. 2 mg/ml)	3			✓
Ranolazine (Tab.500 mg)	1			✓
Trimetazidine (MR Tab. 35 mg)	2			✓

*Multiple responses for different dosages.

Table 2: List of drugs prescribed by consultants for the treatment of cardiac arrhythmias.

Generic Name	No. of consultants prescribed*	WHO EML 2021	NLEM 2022 (India)	Availability in pharmacy
Adenosine (Inj. 3 mg/ml, Inj. 6 mg/ml, Inj. 12 mg/ml)	25		✓	✓
Amiodarone (Tab.100 mg, Tab.200 mg, Inj. 30 mg/ml, Inj. 50 mg/ml)	44	✓	✓	✓
Digoxin (Tab.0.125 mg, Tab. 0.25 mg, Tab.0.5 mg, Oral liquid 0.05 mg/ml, Inj. 0.25 mg/ml)	29	✓	✓	✓
Esmolol (Inj. 10 mg/ml)	8		✓	✓
Lignocaine (Inj. 1%, Inj. 2%)	16		✓	✓
Verapamil (Tab.40 mg, Tab. 80 mg, Inj. 2.5 mg/ml)	25	✓	✓	✓
Mexiletine (Tab.150 mg)	2			
Ivabradine (Tab.2.5 mg, Tab. 5mg, Tab. 10 mg)	10			✓
Isoprenaline (Inj. 2.5 mg/ml)	2			✓
Orciprenaline (Tab.10 mg)	2			
Atropine (Inj. 0.6 mg/ml)	5			✓
Glycopyrrolate (Inj. 0.2 mg/ml)	1			✓

*Multiple responses for different dosages.

In the treatment of hypertension, the NLEM has only 6 specified drugs, and the WHO list has seven drugs. But there are about fourteen drugs that are being prescribed while not being present in either of the lists. Carvedilol and Nifedipine are prescribed by a reasonably good number of consultants, as mentioned in (Table 3). For the management of Shock and Heart Failure, the WHO list has four drugs, and the NLEM has five drugs. It was found that seven drugs which are not on either of the lists were available in the pharmacy, and one drug, present in both lists, is not available in the pharmacy. Adrenaline, Furosemide and Torsemide are prescribed by many consultants, as seen in (Table 4). Only three drugs are on the WHO list and seven drugs in the NLEM list for

Thrombolytic and anti-thrombotic purposes as depicted in (Table 5). But nine drugs that are not on these lists are prescribed and available in the pharmacy. For the management of pulmonary hypertension, sildenafil is prescribed by eight consultants, which is neither on the WHO list nor the NLEM list but is available in the pharmacy. Similarly, in the management of dyslipidemia, the NLEM specifies only Atorvastatin, which is prescribed by fifty-nine consultants (multiple responders), but rosuvastatin is also prescribed by seventeen. Both are available in the pharmacy. NLEM 2022 doesn't have any recommendations for the fixed drug combination for any of the above conditions under study.

Table 3: List of drugs prescribed by consultants for the treatment of hypertension.

Generic name	No. of consultants prescribed*	WHO EML 2021	NLEM 2022 (India)	Availability in Pharmacy
Amlodipine (Tab. 2.5 mg, Tab. 5 mg, Tab. 10 mg)	54	✓	✓	✓
Enalapril (Tab. 2.5 mg, Tab. 5 mg)	31	✓	✓	✓
Hydrochlorothiazide (Tab.12.5 mg, Tab. 25 mg)	24	✓	✓	✓
Labetalol (Tab.50 mg, Tab. 100 mg, Inj. 5 mg/ml, Tab.200 mg)	53		✓	✓
Ramipril (Tab. 2.5 mg, Tab.5 mg, Tab.1.25 mg)	32		✓	✓
Sodium Nitroprusside (Inj. 10 mg/ml)	9			✓
Telmisartan (Tab. 20 mg, Tab. 40 mg, Tab. 80mg)	42		✓	✓
Chlorthalidone (Tab. 6.25 mg, Tab. 12.5 mg)	4			✓
Hydrochlorothiazide (Tab.6.25 mg)	2			
Losartan (Tab.25mg, Tab. 50mg)	4	✓		✓
Bisoprolol (Tab. 2.5 mg, Tab. 5 mg)	7	✓		✓
Carvedilol (Tab. 3.125 mg, Tab. 6.250 mg, Tab.12.5 mg)	11			✓
Olmесartan (Tab. 20 mg)	1			✓
Nifedipine (Tab. 5 mg, SR Tab. 10 mg, SR Tab. 20 mg)	11			✓
Prazosin (Tab.2.5mg, Tab. 5mg, Tab. 10mg, SR Tab. 5 mg)	8			✓
Cilnidipine (Tab. 5 mg, Tab. 10 mg, Tab. 20 mg)	8			✓
Clonidine (Tab. 0.1 mg)	3			✓
Moxonidine (Tab. 20 mg, Tab. 40 mg)	2			
Hydralazine (Tab. 10 mg, Tab 25 mg, Inj. 20 mg/ml)	4	✓		
Nebivolol (Tab. 2.5 mg, Tab. 5 mg)	4			✓

*Multiple responses for different dosages.

Table 4: List of drugs prescribed by consultants for the treatment of shock and heart failure.

Generic Name	No. of consultants prescribed*	WHO EML 2021	NLEM 2022 (India)	Availability in Pharmacy
Digoxin (Tab.0.25 mg, oral liquid 0.05 mg/ml, Inj. 0.25 mg/ml)	28	✓	✓	
Dobutamine (Inj. 50 mg/ml)	26		✓	✓
Dopamine (Inj. 40 mg/ml)	25	✓	✓	✓
Noradrenaline (Inj. 2 mg/ml)	28		✓	✓
Spiroноlactone (Tab. 25 mg, Tab. 50 mg, Tab. 100 mg)	35	✓	✓	✓
Adrenaline (Inj. 1 mg/ml)	14	✓		✓
Eplerenone (Tab. 25 mg, Tab. 50 mg)	2			✓
Metolazone (Tab. 2.5 mg, Tab. 5 mg)	5			✓
Torseмide (Tab.5mg, Tab.10mg, Tab. 20mg, Inj. 10mg/ml)	15			✓
Levosimendan (Tab. 12.5mg)	1			
Furosemide (Tab.10mg, Tab. 20mg, Tab.40mg, Tab. 100mg, Inj. 10mg/ml)	47	✓		✓
Milrinone (Inj. 1mg/ml)	2			✓

*Multiple responses for different dosages.

Table 5: List of medicines prescribed by consultants for use as thrombolytics and anti-thrombotics.

Generic Name	No. of consultants prescribed*	WHO EML 2021	NLEM 2022 (India)	Availability in Pharmacy
Acetylsalicylic acid (conventional/ dispersible/ enteric coated tablets 150 mg, 300 mg, enteric coated tablet 75 mg, 100 mg)	56	✓	✓	✓
Clopidogrel (Tab. 75 mg, Tab. 150 mg)	32	✓	✓	✓
Dabigatran (Tab. 100 mg, Tab. 150 mg)	18		✓	
Enoxaparin (Inj. 40 mg/0.4 ml, Inj. 60 mg/0.6 ml, Inj. 80 mg/0.8 ml)	41		✓	✓
Heparin (Inj. 1000 IU/ml, Inj. 2500 IU/ml, Inj. 5000 IU/ml)	37		✓	✓
Streptokinase (Inj. 750,000 IU/ml, Inj. 1,500,000 IU/ml)	25	✓	✓	✓
Tenecteplase (Inj. 30 mg/vial, Inj. 40 mg/vial)	16		✓	
Tirofiban (Inj. 5 mg/100ml)	2			
Warfarin enteric coated tablet 75 mg (Tab. 0.5 mg, Tab. 1 mg, Tab. 2 mg, Tab. 2.5 mg, Tab. 3 mg, Tab. 4 mg, Tab. 5 mg)	16			✓
Dalteparin (Inj. 5000 IU/ml, Inj. 10,000 IU/ml)	2			
Abciximab (Inj. 10 mg/ml)	2			
Rivaroxaban (Tab. 2.5 mg, Tab. 5 mg, Tab. 10 mg, Tab. 15 mg, Tab. 20 mg)	23			✓
Nicoumalone (Tab. 0.5 mg, Tab. 1 mg, Tab. 2 mg, Tab. 3 mg, Tab. 4 mg)	9			✓
Ticagrelor (Tab. 90 mg)	2			✓
Prasugrel (Tab. 10 mg)	2			✓
Alteplase (Inj. 20 mg/vial, Inj. 50 mg/vial)	2			

* Multiple responses for different dosages.

However, there are a few drugs that are on the WHO list and available in our pharmacy. Many prescribers preferred fixed drug combinations.

DISCUSSION

In a tertiary care hospital, the prescription by the consultants and availability of medicines in the pharmacy should be rational enough to follow the guidelines for the effective outcome of the patient in terms of cost and efficacy. In this study, all twenty-nine drugs in the cardiovascular drug section of the NLEM were prescribed, and in addition, forty-two drugs that were not on the list were also prescribed and available in the pharmacy.¹² This unnecessary procuring of drugs can lead to space occupation and wastage of resources if it is not utilized.

For the treatment of ischemic heart disease, it was observed that apart from the NLEM drugs, Nicorandil, Ranolazine and Trimetazidine were commonly prescribed and available in the Hospital Pharmacy. Surprisingly sublingual Glyceryl Trinitrate, which is present in both lists, was not available in the hospital pharmacy.^{4, 12} Studies have shown a combination therapy of aspirin, beta-blockers, ACE-Is, and statins is cost-effective in the chronic management of IHD. Hence, fixed-dose

combinations should also be included in the NLEM for more effective treatment for patients.¹⁶

In the treatment of cardiac arrhythmias, studies have shown that class 3 antiarrhythmic drug (amiodarone) is the most prescribed drug, even in patients with low socioeconomic status, which is similar to our study.¹⁷ However, very few consultants prescribed ivabradine, isoprenaline, atropine and glycopyrrolate, which are not in the NLEM list but are available in the pharmacy. Mexiletine and orciprenaline were also prescribed by very few consultants and were neither in the NLEM nor in the pharmacy.

Similarly, in the treatment of Hypertension, the NLEM list contains amlodipine, enalapril, hydrochlorothiazide, labetalol, ramipril and telmisartan.¹² Other studies also have shown that mono-therapy and combination therapy of ACEI and CCB were the topmost priority of health clinicians.¹⁸ Telmisartan among ARBs and amlodipine among CCBs were the most commonly prescribed drugs.¹⁸ The diuretics were the least prescribed.¹⁸ Additionally, consultants preferred numerous drugs like Sodium Nitroprusside, Chlorthalidone, Furosemide, Losartan, Bisoprolol, Carvedilol, Olmesartan, Nifedipine, Prazosin, Cilnidipine, Clonidine, Hydralazine and Nebivolol which

are not in the essential drug list. This gives the opportunity for irrational prescribing and unnecessary procurement of drugs in the pharmacy.

The NLEM list for the treatment of Shock and Heart Failure consists of Digoxin, Dobutamine, Dopamine, Noradrenaline, and Spironolactone.¹² Various studies show that loop diuretics like furosemide are most commonly used because of the most potent natriuretic action,¹⁹ which definitely need to be included in the NLEM. Other than the drugs present in the NLEM, drugs like Adrenaline, Furosemide, Metolazone, Torsemide, Eplerenone, Levosimendan and Milrinone were prescribed by a few consultants. The antithrombotic and thrombolytics list in the nlem contains aspirin, clopidogrel, dabigatran, enoxaparin, heparin, streptokinase and tenecteplase which were prescribed rationally by a sufficient number of consultants.¹² Researchers have also shown that the most commonly prescribed aspirin, clopidogrel, streptokinase and enoxaparin are in MI and stroke.^{20,21} Similarly in stroke, apart from these, a few consultants also prescribed warfarin, dalteparin, rivaroxaban, nicoumalone, prasugrel and abciximab, which indicates the diversity of selection of drugs. Warfarin and Rivaroxaban can be considered for the essential drug list. Sildenafil which is prescribed for pulmonary hypertension, is not on the list of NLEM but was prescribed by a few and available in the pharmacy. But studies have shown that it is more effective than Tadalafil and other measures in the management of pulmonary hypertension.²² Hence this drug can be included in the essential drug list. Only Atorvastatin is on the NLEM list and is being prescribed by the majority of consultants, but a few of them also prescribed Rosuvastatin, which is available in the hospital pharmacy for the management of Dyslipidemia.¹² The results are almost similar in terms of cost and efficacy conducted elsewhere.²³ To summarize, the majority of the drugs are prescribed as per the NLEM list.¹² However, many drugs (42) are being prescribed out of the list and available in the pharmacy. Suggestions can be given to the Therapeutic Committee to guide the prescribers to adhere to the NLEM list. Furosemide and sildenafil can be included in the Essential drug list.

Limitations

Limitations of current study were; the participants were limited in number, and if we could include all the consultants, the results might be more significant. There is insufficient literature about the development of an essential drug list.

CONCLUSION

There are a total of seventy-one cardiovascular drugs prescribed by the twenty-eight consultants, out of which only twenty-nine drugs are on the NLEM list. Warfarin, rivaroxaban, sildenafil, furosemide and torsemide, which were prescribed by many consultants, can be considered

for inclusion in the list. The hospital pharmacy did not possess fourteen of the prescribed medicines. Hence directions should be given to the pharmacy to maintain drugs at all times in adequate amounts. The drugs prescribed rarely and by limited people can be kept in limited quantities to reduce the wastage of resources and manpower. Limited drugs can improve the efficiency of rational use and lower costs because of competition.

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