IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Research Article
November 2022 Vol.:25, Issue:4

Evaluation of Prescription Pattern of Inotropes and Vasopressors in Critical Care in a Tertiary Care Hospital in Western Zone of UP, India

IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Priyansha Jain *[(A)], Sobhan Gupta[(A)], Luv Kumar [(A)], Prolay Paul[(B)], Piyush Mittal[(C)]

A. Doctor of Pharmacy- Intern, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001, India.

B. Clinical Pharmacologist, Narayana Superspeciality Hospital, Howrah, West Bengal- 711103. AMC Co-Ordinator, NCC, PvPI, Ghaziabad, India.

C. Professor & Head of Department of Pharmacy Practice, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001, India.

Submitted: 30 October 2022
Accepted: 5 November 2022
Published: 30 November 2022

Keywords: Vasoactive, Inotrope, Vasopressor, Critical care, Mortality, APACHE 2 score, VIS score, TGRS scale, Septic shock, Cardiogenic shock.

ABSTRACT

Vasoactive medications are lifesaving medications that are generally used in critical care units, where clinical management differs significantly. To evaluate the prescription pattern of inotropes and vasopressors in intensive care unit. A prospective observational study of patients admitted to a tertiary hospital ICU for a 6- month period from December 2021 and May 2022 was included. Data from patients' charts were analyzed to describe patient characteristics in critical care. Chi square and ANOVA test were used to analyze data. Out of 140 patients, males were more prevalent than females and mostly the reason of admission was cardiovascular disorders. Survival rate in patients was 79% with rational use of medications well established. Drug utilization pattern shows predominant use of inotropes than vasopressors in critical care.

HUMAN JOURNALS
www.ijppr.humanjournals.com

INTRODUCTION

Vasoactive agents play a vital role in the management of different types of shocks that complicate myocardial infarction or ischemia and in stabilizing the hemodynamic variability occurring amid coronary arbitrations. Patients at risk for hemodynamic collapse are stabilized with use of these drugs as adjunctive therapy which serves as a therapeutic aid for the management of major coronary artery disease such as acute decompensated heart failure, CS following acute MI and also patients undergoing major surgery and trauma especially to critically ill patients with intense hemodynamic impairment. These drugs have afferent and efferent effects on the heart and vascular smooth muscle, as well as essential metabolic, central, and pre-synaptic autonomic nervous system effects. [(1)]

Hemodynamic monitoring is used to detect circulatory insufficiency, it's likely etiology, and treatment response in critically ill patients.[(1)] Even Nevertheless, proving the effectiveness of monitoring is difficult because no tool improves outcomes unless it is used in conjunction with a treatment that does.

Hemodynamic monitoring relies on measurements of cardiac output and SaO_2 levels rather than filling pressures to assess the adequacy of resuscitation efforts. Although these procedures minimize mortality and morbidity in high-risk patient categories, broad adoption of monitoring-driven treatment regimens has yet to occur. [(2-4)]

Inotropes are agents that effect myocardial contractility by altering its force and strength and vasopressors being sympathomimetic drugs causes vascular smooth muscle vasoconstriction which increase vascular tone. Generally, these agents administered with the conviction that clinical recuperation is going to encouraged through improvement of cardiac output (CO) or vascular tone that's been severely harmed by a fatal condition. [(41)] The reason of modifying a patient's hemodynamics within the intense circumstances is to guarantee adequate oxygen conveyance to imperative tissues (to prevent or manage shock).

Shock is defined as inadequate oxygen and energy delivery to organs and is connected with high mortality and morbidity .[(5)] Traditionally, four forms of circulatory shock have been separated by pathophysiological mechanisms: hypovolemic, cardiogenic, distributive, and obstructive shock.

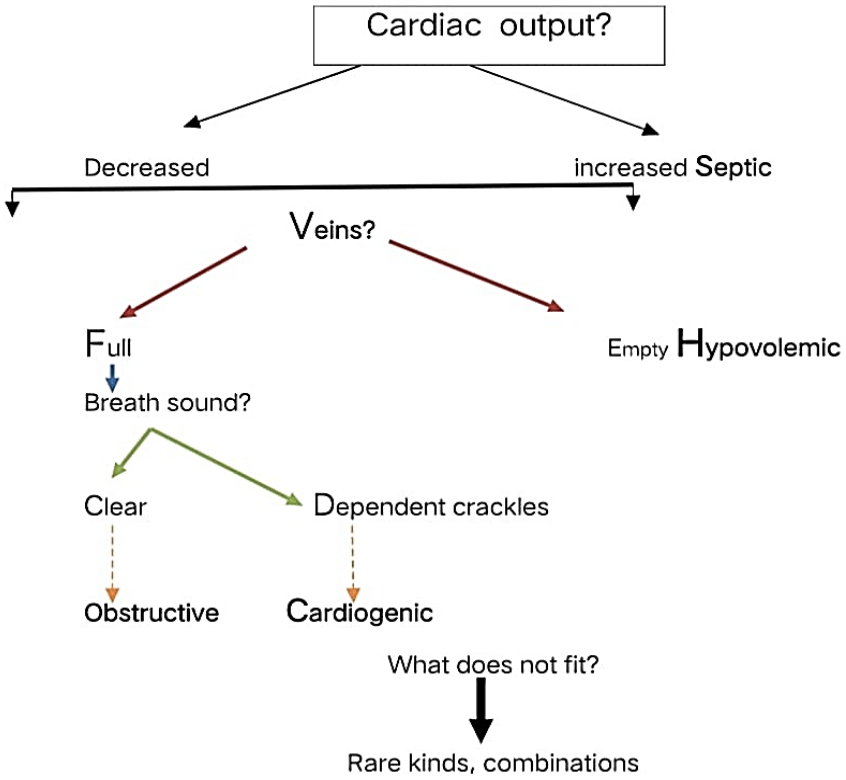

FIG:1- Classification of shock syndrome.

Critically ill patients manifest with one or more of these four kinds of circulatory failure. The capacity of the circulation to balance oxygen supply to tissue oxygen requirements determines survival in shock. [6]

It is critical that this is accomplished before lasting tissue damage occurs. Therapy that is appropriate but delayed may be futile, since there comes a moment in the natural history of shock where there is no return. [7,8]

Insufficiency of oxygen delivery to the tissues is due to:

• Low cardiac output to fulfill the demands of the body or organ.

• Despite a sufficient cardiac output, the perfusion pressure is modest.

Below is the overview of the steps to be followed whenever a patient with shock syndrome admitted in critical care unit.[8-12]

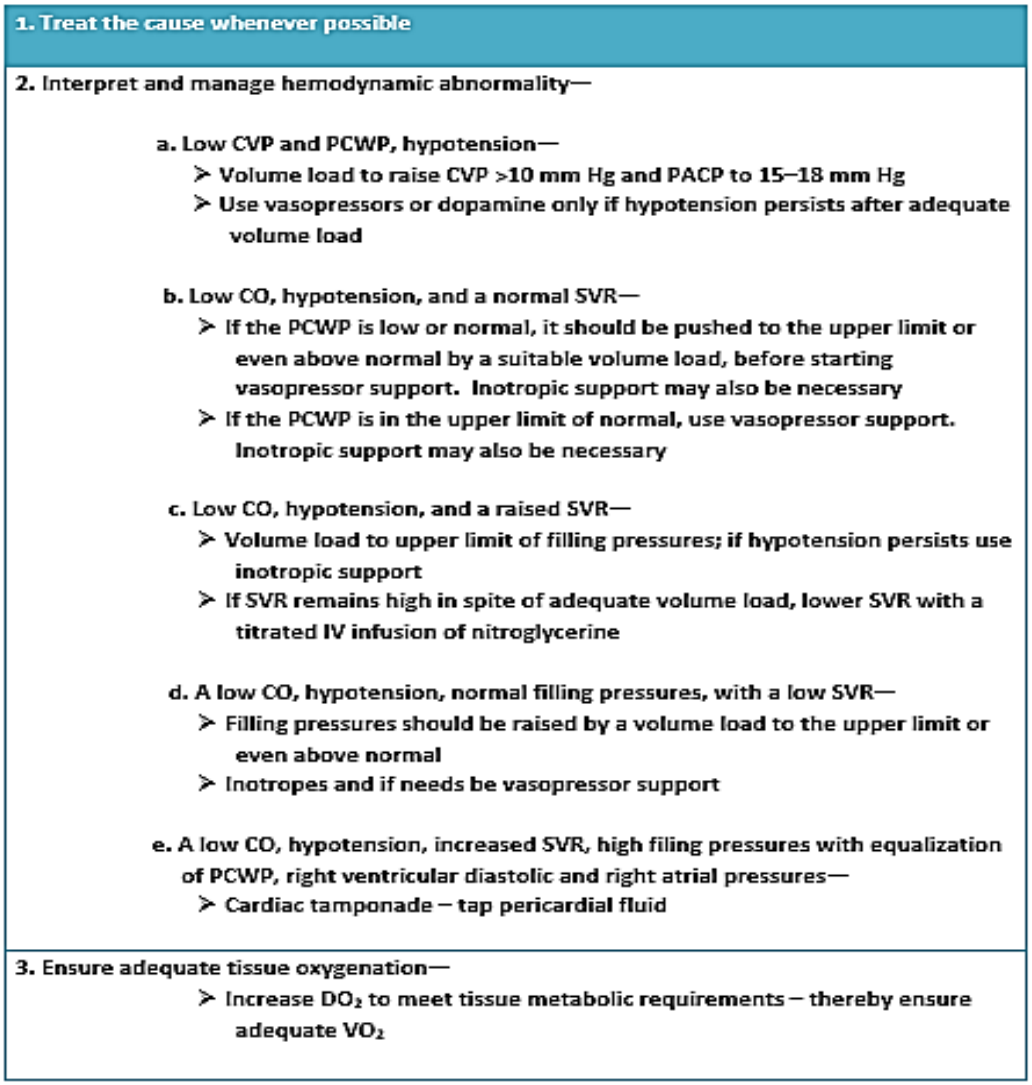

FIG:2- Management of patient with hemodynamic instability in critical care.

Vasoactive agents [22]

There are various types of vasoactive agents use on daily basis on critical care, they are like double edge sword as they can be boom for the patient health if taken with caution but also can be fatal at the same time .[13,14] clinicians need to keep close eye on these agents as small titration have bigger effects on hemodynamic parameters. Below is a short description of most commonly used agents and their role along with considerations need to be taken into account.

Agents	Mechanism	Effect	Indications	Considerations
Phenylephrine	A1 agonist	Vasoconstriction	Various forms of shock	Caution in cardiac dysfunction as it increases afterload
Norepinephrine	A<B agonist	Inotropy, chronotropy, dromotropy, and vasoconstriction	Most common first line agent in shock	Most benefits demonstrated in septic shock
Epinephrine	A≪B agonist	Inotropy, chronotropy, dromotropy, and vasoconstriction	Commonly used as second line agent or first line in anaphylactic shock	Surviving Sepsis Guidelines has most data for epinephrine as second line agent
Dopamine	Dose dependent A, B, and D agonism	Inotropy, dromotropy, chronotropy, and vasoconstriction (at highest doses)	Second line agent in most forms of shock	SOAP II trial demonstrated more incidence of tachy-arrythmias and increased mortality in CS patients when dopamine was used as first line
Vasopressin	V1 agonist	Vasoconstriction	Second line agent in most forms of shock	On or Off dosing, can cause hyponatremia
Dobutamine	B agonist	Inotropy and mild vasodilation	Commonly used in cardiogenic shock	May contribute to hypotension
Levosimendan	Myofilament Ca^{2+} sensitizer and K^{+} channel modifier	Ionotropy and inodilator	Used in acutely decompensated chronic heart failure	Minimal effect on myocardial oxygen consumption

FIG: 3- Most commonly vasoactive agents used in critical care.

Their clinical Excellency or outcome has been intensively investigated via examining and evaluating their effects on electrocardiographic end points., along with medical practice under the guidance of expert opinion.(15-19)

This study aims to evaluate how inotropes and vasopressors are prescribed in hemodynamic management, as well as to analyze the currently available vasoactive and their specific applications. High doses and prolong use of these agents can cause cardiac toxicity, as well as an increase in mortality rate.(20-25) The goal of this study is to evaluate the accuracy of doses administered and to investigate the link between vasoactive treatment and 30-day mortality .

AIM AND OBJECTIVES

Aim

To evaluate the prescription pattern of inotropes and vasopressors in intensive care unit.

Objectives

1. To assess how inotropes and vasopressors are prescribed, administered in hemodynamic management.

2. To facilitate rationale, use of medication and verification of accuracy of doses.

3. To investigate to what extent specific factors, influence ICU length stay and mortality of patients on inotropes and vasopressors.

4. To analyze the association of inotrope and vasopressor treatment with mortality.

5. ADR monitoring in terms with inotropes and vasopressors if any.

MATERIALS AND METHODS

This is a prospective observational study of a single centered with six-month duration ;the study was conducted in the intensive care unit at tertiary care teaching hospital. To get the permission of the institutional ethical committee, the systemic protocol was followed, in which all the documents were submitted. This study was approved by the institutional ethical committee.

Consent:

All patients who took part in the study provided their informed consent.

Selection Criteria of Patients:

Inclusion Criteria

1. Patient with age 18 years and above.

2. All subjects admitted in intensive care unit

3. GENDER- both male and female

4. Post-operative patients

Exclusion Criteria

1. Pregnant and lactating mothers.

2. Children under the age of 18 years.

3. Psychiatric illness.

4. Patient not willing to participate.

Procedure:

- The current study comprised all adult patients (age > 18 years) admitted to the hospital intensive care unit.

- Only one of a patient's admissions with a diagnosis was chosen if he or she had several admissions with a diagnosis.

- Patients receiving intravenous vasoactive therapy are admitted to one of the hospital's five adult intensive care units, which include MICU, SICU, CTVS, NICU, and RICU.

- The following data was taken from the patient's ICU documentation for each vasoactive agent- name, start date and time, stop date and time, and maximum dose administered, as well as the patient's age, gender, length of stay in the ICU, and survival or discharge status.

- Patient's laboratory findings were noted and assessed according to APACHE 2 score.

- VIS scoring was calculated after 24 hrs. of admission considering the highest dose of vasoactive agents administered.

Tools used

APACHE 2 scoring, VIS scoring, TGRS form, WHO INDICATORS, SPSS22.0

Sampling Technique

The 140 patients who were admitted to the intensive care unit were on vasoactive treatment. Calculation of sample size using the sample size equation with a confidence interval (CI) of 95% and a margin of error of 5%.

Sample size was calculated using the formula,

$$n=z^2 * p*(100-p)/ e^2$$

$$n= (1.96)^2 * 10.25 *(100-10.25) /(5)^2$$

n=140 with vasoactive agents.

Statistical Analysis

Data was compiled on Excel sheet and data was analyzed using SPSS 22.0 and test used for correlation are – chi –square test and ANOVA test.

OBSERVATION AND RESULTS

Table no. 1 Study Population Characteristic

S. No.	Parameters	Mean	Standard deviation (N=140)
1.	Age	50.5 yr.	5.68
2.	Weight	55.1 kg	11.1
3.	Height	1.60 m	0.07
4.	BMI	21.40	3.56
5.	MAP	85	58.33

Above table shows there is significant positive correlation between the all parameters.

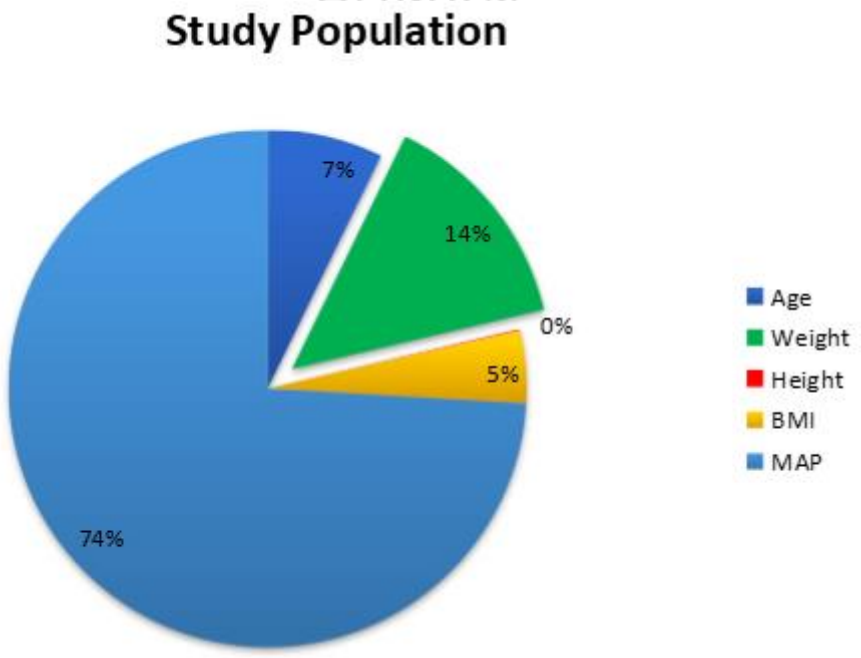

Fig 4

❖ For evaluation, we use the criteria in which total of 140 of critical care patients were studied during the period of 6 months in a tertiary care teaching hospital in north region of India. Among 140 patients 95 patients were prescribed with inotropes and 45 were prescribed with vasopressors.

❖ In our study, patient belong to age 41-60yr age group is more prominent. Our study source that in critical care patient there were more males than females.

Table no. 2 Distribution of Age Group

S. No.	Age Group	Number	Frequency (%)
1.	18 above	10	7.14
2.	21-40	45	32.14
3.	41-60	65	46.42
4.	61-80	15	10.71
5.	80 above	5	3.57
	Total	**140**	**99.99**

The average age of population was 50 years. Most of the patients (46.42%) were in the age group 41-60 years.

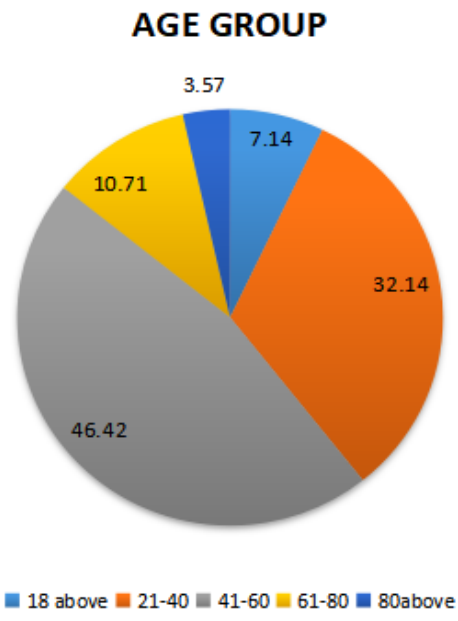

Fig 5

Table no. 3 Frequency distribution according to Gender

Gender	Number	Frequency (%)
Male	84	60
Female	56	40

Above table shows distribution of study group as per sex. Male patients were prone as compare to female,

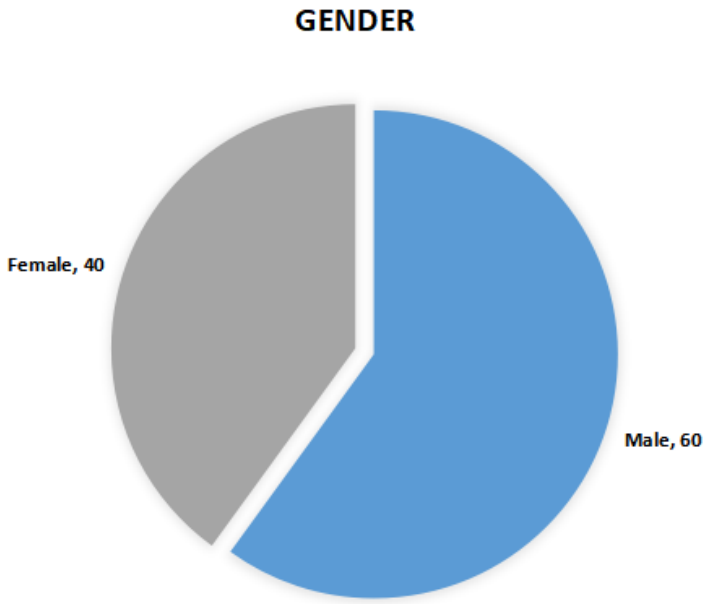

Fig 6

Table no. 4 Distribution of Study Group

Study Group	Number	Frequency (%)
Inotropes	95	67.85
Vasopressors	45	32.15

Out of 140 patients; (95) 67.85% prescribed with inotropes and (45) 32.15% patients prescribed with vasopressors.

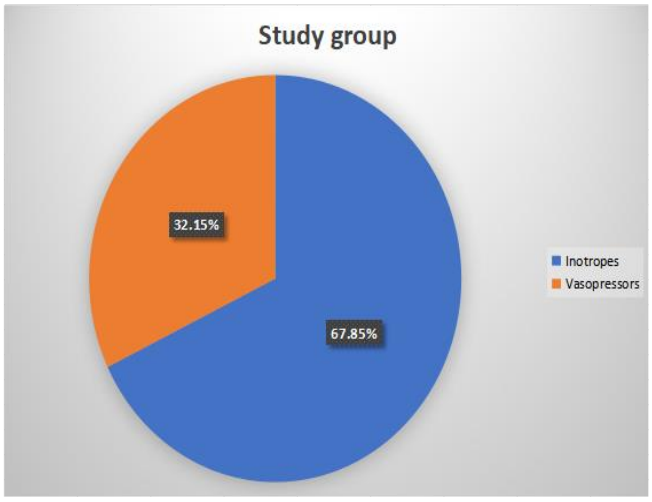

Fig 7

Table no. 5 Association Among study group and Laboratorial markers

Drug	**Renal Function**				**Hepatic Function**			
	Serum Creatinine				**AST/ALT**			
	<0.5		**>1.5**		**<8**		**>48**	
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Inotropes	40	42.1	55	57.9	45	47.3	50	52.6
Vasopressor	30	28.88	15	33.33	38	84.44	7	15.5

Chi-Square tests	**SD**	**p-value**	**Association**
Renal function	48.55	0.028	Significant
Hepatic function	8.833	0.012	Significant

*Signifies p-value is <0.05

Above table shows distribution of inotropes and vasopressors in relation with laboratory parameters. lab markers are of more commonly seen in inotropes although this distribution is found to be significant.

Table no. 6 Utilisation of Inotropes & Vasopressors in ICU Patients

S.N.	Drugs	Number	Frequency (%)
1.	Noradrenaline	47	33.57
2.	Dopamine	2	1.42
3.	Dobutamine	3	2.14
4	Labetalol	1	0.71
5	Vasopressin	40	28.57
6	Labetalol/Noradrenaline	2	1.42
7	Amlodipine/ Noradrenaline	1	0.71
8	Adrenaline/Noradrenaline	1	0.71
9	Noradrenaline/Propranolol	1	0.71
10	Dopamine/Dobutamine	1	0.71
11	Dopamine/Noradrenaline	20	14.28
12	Dobutamine/Noradrenaline	8	5.71
13	Atropine/Noradrenaline	1	0.71
14	Noradrenaline/ Digoxin	1	0.71
15	Vasopressin/Noradrenaline	2	1.42
16	Noradrenaline/Dopamine/Dobutamine	6	4.28
17	Noradrenaline/Dobutamine/Dopamine/Vasopressin	2	1.42
18	Noradrenaline/Dopamine/Dobutamine/Digoxin	1	0.71

Above table shows the use of inotropes and vasopressors as prescribed in combination and it was observed noradrenaline was the most preferred inotrope.

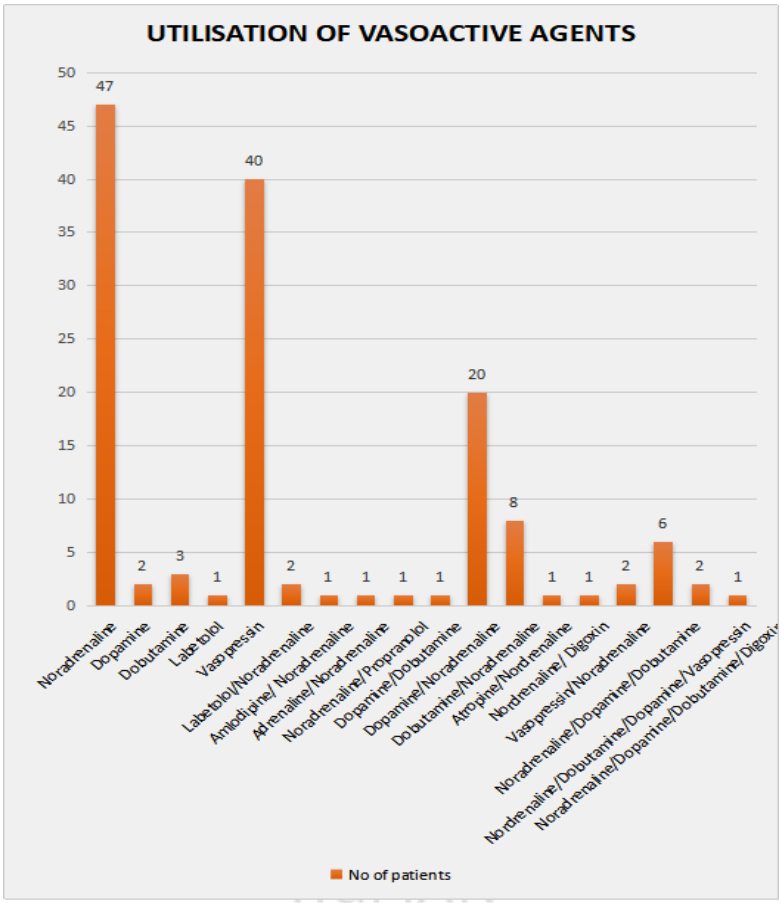

Fig 8

Table no. 7 Frequency distribution according to Diagnosis

Diagnosis	**Number**	Frequency **(%)**
Cardiovascular diseases	63	45.00
Neurologic disorders	11	7.85
Respiratory diseases	15	10.71
Co-morbidities	51	36.42
Total	**140**	**99.98**

Above table shows the study group distribution according to diagnosis criteria and cardiovascular patients were mostly admitted in Intensive care for the need of hemodynamic management.

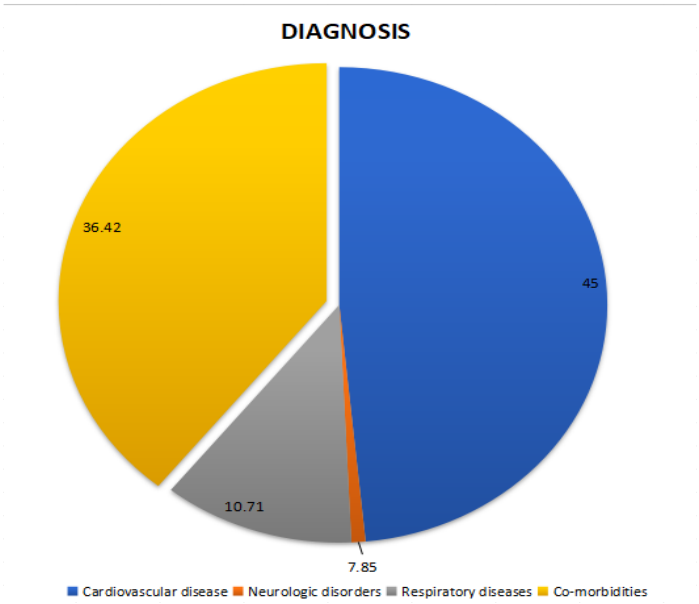

Fig 9

Table no. 8 Rational use of Study Group

Drug	**MAP**						**WHO indicator**			
	>70		**70-100**		**100<**		**Rational**		**Non-Rational**	
	No.	%	No.	%	No.	%	No.	%	No.	%
Inotropes (n=95)	35	36.8	53	55.78	7	7.36	65	68.42	30	31.57
Vasopressor (n=45)	20	44.4	12	26.66	13	28.88	30	66.66	15	33.33

Chi-Square tests	**SD**	**p-value**	**Association**
MAP	15.67	0.029	Significant
WHO	13.45	0.022	Significant

*Signifies p-value is <0.05

Above table shows that rationality of drugs was significant and hemodynamic management was established successfully.

Table no. 9 Relation between mortality rates with study group

Class	Mortality =13		Morbidity=127		One-way ANOVA
	Number	%	Number	%	
Inotropes	10	10.5	85	89.4	0.3922
Vasopressor	3	2.14	42	30.00	not significant

Above table shows that mortality was less and survival rate and quality of patient's life was well established.

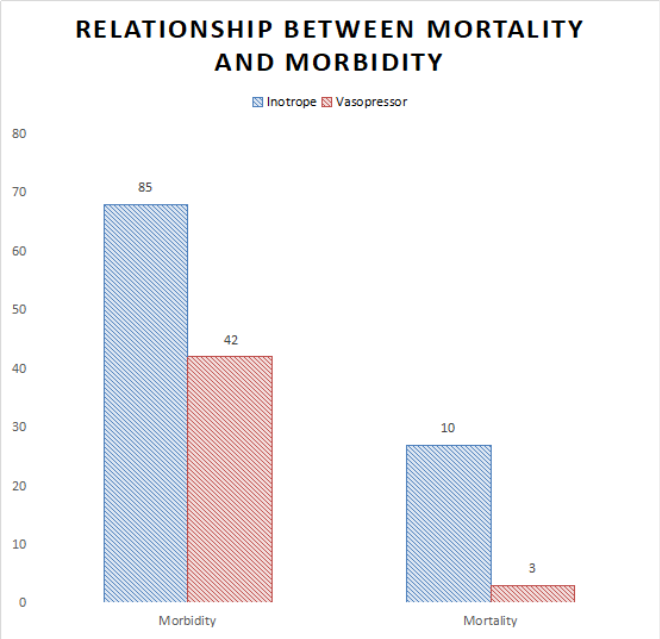

Fig 10

Table-10 Frequency distribution according to VIS- score

VIS SCORE	Number	Frequency %	SD	-value
>5-15	48	24.28	15.81	0.029
>15-30	68	48.57	21.60	
>30-45	24	17.14	7.90	

*Signifies p-value is <0.05

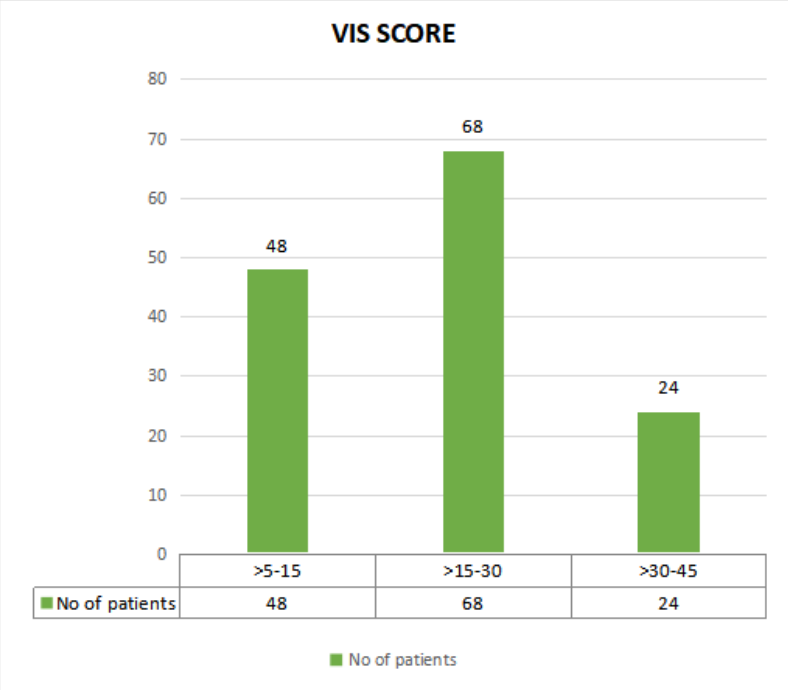

Fig 11

Above table shows the VIS SCORE calculated after 24 hr. admission of patient, generally it is used to depict the mortality and morbidity of patient and it shows, VIS score of most patients lies between normal range.

Table -11- Frequency distribution according to APACHE 2 score

S. N	Parameters	Scoring	Number	Frequency	SD	p-value	Association
1.	**Heart Rate**	0	41	29.28	12.90	0.001	Significant
		2	21	15			
		3	65	46.42			
		4	13	9.28			
2.	**Renal**	2	70	50	15.17	0.001	Significant
		3	70	50			
3.	**Respiratory**	0	32	22.85	11.97	0.023	Significant
		1	57	40.71			
		3	31	22.14			
		4	20	14.28			
4.	**Age**	0	55	39.28	05.68	0.019	Significant
		3	65	46.42			
		5	15	10.71			
		6	5	3.57			

*Signifies p-value is <0.05

Different clinical parameters were noted and scored for evaluation of mortality and quality of life of patient for this APACHE 2 score was used and mainly 4 categories were taken into consideration and data was more significant.

Table no. 12 Distribution of Length of ICU stay

Class	No. of cases	%	SD	P-value
0-5	76	54.28	6.450.018	
5-10	46	32.85		
10-15	15	10.71		
15-20	3	2.14		

*Signifies p-value is <0.05

Above table shows the ICU length stay of patient and most of the patients were observed to be admitted less than 5 days in the ICU.

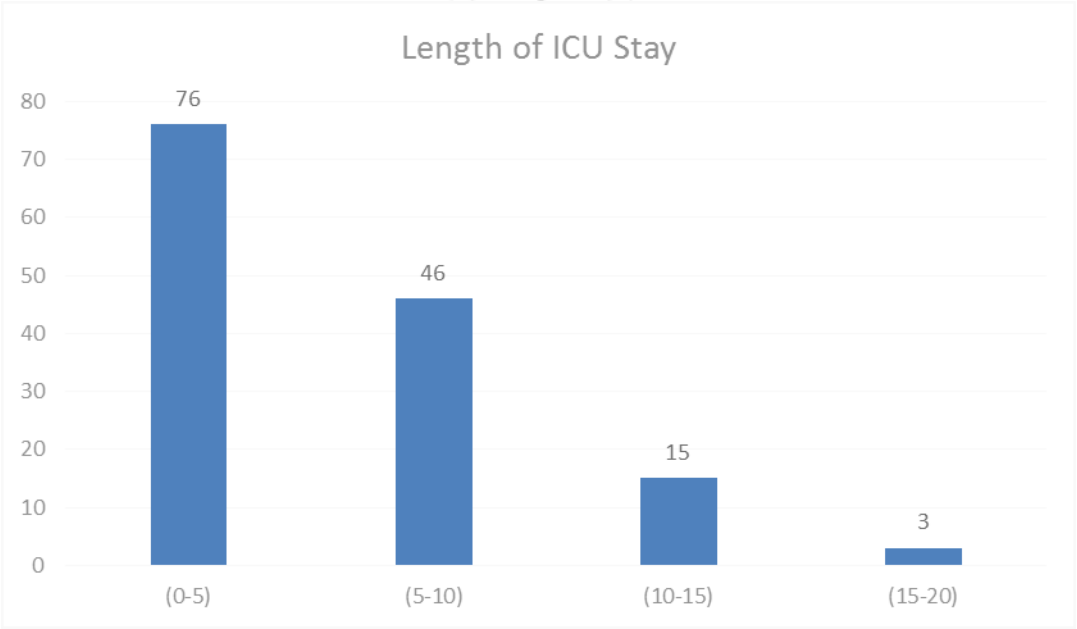

Fig 12

Table no. 13 Length of stay according to multiple parameters

S. No.	Parameters	Number	%	p -value	Survival rate	Mortality rate
1.	MAP	140	100	0.029	90.8%	9.2%
2.	APACHE 2 SCORE	140	100	0.001	90.8%	9.2%
3.	VIS SCORE	140	100	0.029	90.8%	9.2%

*Signifies p-value is <0.05

Above table shows all parameters which were used for mortality and quality of life evaluation and they were found significant.

Table no. 14 Safety assessment of inotropes & vasopressors in patients

S.No.	Tolerability of global scale	Frequency
1.	Excellent	35.71
2.	Good	39.28
3.	Average	3.5
4.	Poor	21.42

The large proportion of patients have no side effects (78.64%). minor side effect was noted few patients (1.5%, abdominal pain, 2.5% dizziness & moderate side effect were tachycardia 6% bradycardia 4% dyspnea 5% chest pain 2%). The response & tolerability to therapy were recorded on 5-point rating scale. Majority of the patients give satisfactory response to the treatment.

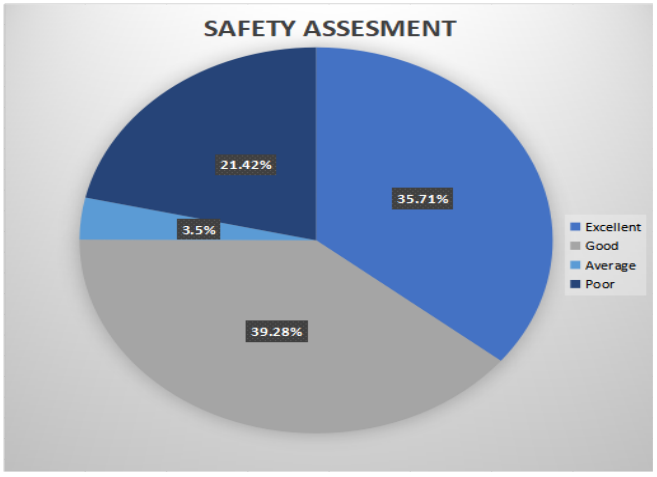

Fig 13

DISCUSSION

Several relevant observations were made in the present study.

1. **AGE**

The average age was 50.5 years and the study analyzed that 41-60 years' age group were in more need of vasoactive treatment in comparison to other groups which is in accordance with study conducted by (Ravula S. *et al.).*[32]

2. **GENDER**

Men have high prevalence of cardiovascular disease than women as 45% of the study population was admitted for cardiovascular disorders. [36]

3. **BMI**

Weight and BMI consideration while dose adjustment is taken into consideration as first step, we found a positive correlation between BMI, weight, height with dose calculation in case of vasoactive agents.

4. **INDICATION**

Noradrenaline was the most commonly used inotrope in hospitals (27.5%), followed by Dobutamine (12.5%), Dopamine/Noradrenaline (11.5%), Dopamine (8.5%), Dopamine/Dobutamine/Noradrenaline (8.5%), Adrenaline (6%), Dobutamine/Noradrenaline (6.5%), Adrenaline/Dobutamine/Noradrenaline (6.5%), Dobutamine/Noradrenaline (5 percent). In critical care situations, noradrenaline is the preferred medication since it has less side effects, but equal efficacy in comparison to others. Adrenaline is more effective than noradrenaline but requires precise hemodynamic monitoring, thus it is only used in situations where stringent hemodynamic monitoring is available. Adrenaline is also linked with a larger number of negative effects than others.[26] Whereas, in our study we observed that noradrenaline was most frequently prescribed inotrope i.e (33.57%), followed by Dobutamine (2.14%), Vasopressin is the most prescribed vasopressor in critical care with 28.57%, Dobutamine + Noradrenaline (14.28%) is the most preferred combination therapy followed by Dobutamine+ Noradrenaline (5.71%). Triple therapy was also observed in 4.28% population for rigorous haemodynamic stability.

When fluid delivery fails to restore appropriate arterial pressure and organ perfusion in septic shock patients, vasopressor therapy should be commenced. The ultimate aims of such treatment in shock patients are to reestablished efficient tissue perfusion and regulate cellular metabolism , [27] in our study as well we observed extensive use of noradrenaline as first line agent in patients, with septic shock.

A recent randomized controlled trial and a meta-analysis of individual data revealed that norepinephrine may be favored over epinephrine in individuals with CS following MI. Under advanced surveillance, the use of vasopressin may be recommended in individuals with right ventricular failure and pulmonary hypertension, [15] we observed that vasopressin use was prominent after the failure of norepinephrine and dopamine dual combination therapy in patients with CS following MI.

Low doses of epinephrine or dopamine can be utilized for inotropic support, but large doses of these medicines for vasopressor support pose an elevated risk of adverse effects and should be avoided. When Noradrenaline alone is insufficient to produce an appropriate arterial pressure, the inclusion of a non-catecholamine vasopressor like vasopressin, along with rescue therapies that may increase vasopressor response, is justified. [34] in our study we concluded that addition of vasopressin as additional therapy for enhance vasopressor effect is more justified and practiced not only in cardiac patients but also in other conditions to ultimately prevent cardiopulmonary arrest in patients.

According to the Surviving Sepsis Campaign Guidelines 2016, the evidence on the management of shock after 2010 does not support the use of dopamine in treating patients with shock in general. Despite this, dopamine usage has been discovered in the literature in recent years, [36-38] in present study dopamine was used in majority of patients but with another inotrope as a combination for treating shock.

5. **RATIONALITY**

In this study vasoactive agents are assessed for rationality in accordance with MAP value and WHO indicators, accuracy of doses was verified and found that 68.42 % inotropes and 66.66% vasopressors were rationally prescribed according to WHO indicators standard guidelines, data being statistically significant (p value-0.022). While rationality was found to greater in accordance with MAP values and data was significant (p value- 0.029). [26,27,29,39]

6. MORTALITY AND ICU LENGTH STAY

The mortality rate was found to be 9.2% in study population, though the impact of inotrope and vasopressor use on mortality is controversial. The mortality in patients with inotropes use (p value- 0.3922) was found greater as compared to vasopressor, the data was found non-significant in case of vasopressor.

In a metacentric cohort study, it was concluded that increasing the intensity of vasopressor dose during the first 24 hours following septic shock was linked to an increase in mortality. The quantity of early fluid delivery and the time of vasopressor titration both influenced this relationship. [31,33] Dobutamine was found to dramatically reduce ICU mortality in this study. These findings suggest that Dobutamine can be prescribed for ICU patients, but that it should be used in conjunction with vital sign or hemodynamic monitoring.

In an adult population, VISmax independently predicted undesirable outcomes following cardiac surgery, including short- and intermediate-term morbidity and death. Furthermore, when VISmax score grew, so did the length of ICU hospitalization, [26] in the present study VISmax score was used to establish association of mortality and length of ICU stay and we observed with increasing VIS score probability of length of stay increases. The data was statistically significant with (P value -0.029).

When it comes to predicting ICU mortality in critically sick patients, the APACHE II score has a substantial discriminative ability and it was concluded that hemodynamic parameters such (HR, RR), low PaO2 level, renal function in serum creatinine level and increasing age are the factors that are associated with longer ICU stay and mortality in intensive care patients. While patients with higher APACHE II scores had a considerably greater risk of ICU death, indicating that acuity of disease is associated with a longer length of ICU stay in this patient population. Demonstrating the use of APACHE as mortality prediction scores, with data being statistically significant (p value-0.001).

With increasing age, it is more difficult to stabilize haemodynamic parameters of the patient and which increases the risk of ICU mortality, each year there is an increase of 6.5% of ICU admission of the people >85 years of age.[41] The data was statically significant with (p value- 0.009).

It was also observed that renal and hepatic dysfunction in patients increase the risk of mortality and also contribute to longer length of ICU stay. Renal impairment was assessed by serum creatinine level and (57.9%) of patients were observed with increased levels (>1.5), while hepatic parameters AST/ALT were observed on the lower end of values but have significant role in longer length of ICU hospitalization. The data was statistically significant with (p value-0.001).

MAP (mean arterial pressure) analysis was a key tool to check the association of BP with longer ICU length stay and it was observed that (36.8%) of patients were observed in low MAP levels and longer stay in ICU. The data was statistically significant with (p value – 0.029).

7. SAFETY ASSESMENT

When utilized inappropriately, vasoactive drugs can cause arrhythmias, cardiac arrest, stroke, and tissue necrosis. [39,4,41] In our study patients were evaluated for side effects and majority were found to be free of side effects but (1.5%, abdominal pain, 2.5% dizziness & moderate side effect were tachycardia 6% bradycardia 4% dyspnea 5% chest pain 2%) was observed in 21.36% patients and was based on tolerability global scale on 5-point rating.

CONCLUSION

This research work analyzed currently available and administered inotropes and vasopressors in critical care and assess their indications in particular situations.

-Drug utilization pattern shows predominant use of inotropes than vasopressors in critical care. Noradrenaline was frequently administered in patients for hemodynamic management. On basis of potency and safety profile Noradrenaline was most preferred vasoactive agent in comparison to other.The current research work assessed the factors influencing the mortality and morbidity of patients on vasoactive agents which include hemodynamic parameters, hepatic failure, respiratory failure, renal impairment.

According to this study rational use of medication was higher and most of them are prescribed according to standard guidelines, we observe few deviations in doses of dopamine, noradrenaline and vasopressor.Association of vasoactive treatment with mortality was analyzed and mortality rate was found to be 9.2% in patients on vasoactive treatment.

NEED OF STUDY

Intensive care patients often require vasoactive support to stabilize circulation and to optimize oxygen supply. They are potent medications used in intensive care to control a patient's heart rate, blood pressure, and cardiac contraction force. Being narrow therapeutic in nature little deviation in rate of infusions of these agents are capable of producing a rapid response in the patient's heart rate and blood pressure which can be fatal in some cases, and since blood pressure maintenance is so reliant on vasoactive infusions, careful titration and continuous monitoring are essential. Prolong and high doses of these drugs may lead to cardiac toxicity and increase mortality rate. At present there are only few prescription pattern analysis studies that have been conducted in emergency settings in India. Intensive care unit was an excellent platform for conducting usage pattern study for vasoactive drugs as the uses of these agents are extensive in this department. This study can be used to estimate the number of patients exposed to different inotropes and vasopressors within a given period of time. This can also be used to estimate the proper utilization of vasoactive agents. The study on prescription pattern in turns serve as a vital tool to determine rational drug therapy and improves patient's quality of life. When patterns are tracked over time and trends in medication usage can be established, prescription pattern analysis may be utilized as part of a continuous assessment program to identify the extent to which alternative medicines are being used in certain situations.

LIMITATIONS OF STUDY

- This is a hospital-based study for a shorter period of time, so may not be applicable for general population.
- APACHE 2 scoring was done mainly on 4 parameters for correlation.
- Inotropic treatment is mainly physician driven and often deviates from the standard guidelines.

RECOMMENDATIONS

Despite their extensive usage, there is a paucity of data to support the use of inotropes and vasopressors in critically sick patients. Though, many patients would not live without inotropic assistance, but clinical practice varies greatly. Vasoactive agents are double edge

swords that can make or break the situation, as we are dealing with emergency situations where risk of fatality can rise rapidly within seconds, standard practice protocols must be applied in hospital critical care units for dosing considerations and close monitoring while prescribing these agents.

There are few big randomized controlled trials that directly evaluate drugs in terms of survival or other patient-relevant outcomes, which is the level of proof that doctors are increasingly demanding. However, present practices may be improved by gaining a better knowledge of the various properties of these medicines as well as their potential toxicity. Until the data base improves, it is sensible to utilize the very minimal dosages of such drugs.

LIST OF ABBREVIATION

CVS	CARDIOVASCULAR
CS	CARDIOGENIC SHOCK
AKI	ACUTE KIDNEY INJURY
CO	CARDIAC OUTPUT
MAP	MEAN ARTERIAL PRESSURE
RR	RESPIRETORY RATE
HR	HEART RATE
VIS	VASOACTIVE INOTROPIC SUPPORT
APACHE	ACUTE PHYSIOLOGICAL ASSESMENT AND CHRONIC HEALTH EVALUATION
SPO2	OXYGEN SATURATION
TGRS	TOLERABILITY GLOBAL RATING SCALE
MI	MYOCARDIAL INFARCTION
STEMI	ST ELEVATION MYOCARDIAL INFARCTION
NTEMI	NON ST ELEVATION MYOCARDIAL INFARCTION
GFR	GLOMERULAR FILTERATION RATE

REFERENCES

1. Mansoor N Bangash, Ming-Li Kong, Rupert M Pearse.:Use of Inotropes and vasopressors Agents in Critically ill Patients Pharmacology and clinical applications of inotropes; British Journal of Pharmacology; 2012, P. 165
2. Michael R.Pinsky : Hemodynamic Evaluation and Monitoring in the ICU; Volume 132, Issue 6, December 2007, 2020-29
3. Jacob C Jentzer , Steven M Hollenberg.et. al,:Vasopressor and Inotrope Threapy in cardiac critical care; J Intensive care med. ;2021 Aug;36(8)p.843-56.
4. Steven M. Hollenberg. :Vasoactive Drugs in Circulatory Shock: , Am J critical care medicine, 2011, volume-183 p.847-55.
5. Rudd KE, Johnson SC, Agesa KM, et al.: Global, regional, and national sepsis incidence and mortality, 1990-2017: analysis for the Global Burden of Disease Study. Lancet (London, England). 2020;395(10219):200-11.
6. Daniel L Arellano, Sandra K Hanneman.: Vasopressor weaning in patients with septic shock; Critical Care Nurs Clin North Am. 2014 Sep;26(3) p.413-25.
7. Marilee D Obritsch, Rose Jung, Douglas N Fish, et. Al.: Effects of continuous vasopressin infusion in patients with septic shock" Ann Pharmacother. Jul-Aug 2004;38(7-8)p.1117-22.
8. Pathogenesis of Sepsis and Potential Therapeutic Targets; International Journal of Molecular Sciences 2019;20(21):5376
9. De KI, Van DC, Poelaert J.: Sepsis and septic shock: pathophysiological and cardiovascular background as basis for therapy; Acta Clin Belg. 2010;65(5):323-29
10. Court O, Kumar A, Parrillo JE, Kumar A.:Clinical review: myocardial depression in sepsis and septic shock. Crit Care. 2002;6(6):500-08.
11. Rubulotta F, Marshall JC, Ramsay G, et. Al.: Predisposition, insult/infection, response, and organ dysfunction: a new model for staging severe sepsis; Crit Care Med. 2009;37(4):1329-35
12. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021, Critical Care Medicine: November 2021 - Volume 49 - Issue 11 - p e1063-143
13. Ukor IF, Walley KR. Vasopressin in vasodilatory shock. Crit Care Clin. 2019; 35:247–61
14. Nagendran M, Russell JA, Walley KR, et al.: Vasopressin in septic shock: An individual patient data meta-analysis of randomised controlled trials. Intensive Care Med. 2019; 45:844–855
15. Levy, Bruno, Klein, et. Al.: "Vasopressor use in cardiogenic shock" Data and interventional trials on vasopessors; Current opinion in critical care; August 2020, Volume-26 issue-4, p.411-16.
16. Page DL, Caulfield JB, Kastor JA, DeSanctis RW, Sanders CA. Myocardial changes associated with cardiogenic shock. N Engl J Med. 1971;285(3):133-137
17. De Luca L, Olivari Z, Farina A, et. Al.: Temporal trends in the epidemiology, management, and outcome of patients with cardiogenic shock complicating acute coronary syndromes: management changes in cardiogenic shock; Eur J Heart Fail. 2015; 17:1124–32
18. Fei Goa and Yun Zhang :"Inotrope use and Intensive care unit Mortality in Patients with Cardiogenic Shock" Identify inotropes that are superior in improving mortality outcomes in cardiogenic shock patients;Frontiers in Cardiovascular Medicine; Vol 8 September 2021
19. Pfisterer M. Right ventricular involvement in myocardial infarction and cardiogenic shock. Lancet. 2003;36
20. Mitchell H. Rosner, Mark D. Okusa: Acute kidney injury associated with Cardic Surgery; Clinical Journal of the American Society of Nephrology; 2006, vol – 1, p. 19-32.
21. Dattu Hawale, Yeshwant Lamture, Om D. Savadatkar: Acute Kidney Injury; The Electrochemical Society; 2022, vol 107, issue 1.
22. M Vives, A Hernandez , F Parramon, et. Al.: Acute kidney injury after cardiac surgery: prevalence, impact and management challenges; International Journal of Nephrology and Renovascular Disease; 2019, vol 12, p. 153-66.
23. Australian and New Zealand Intensive Care Society (ANZICS) Clinical Trials Group: Low-dose dopamine in patients with early renal dysfunction: aplacebo-controlled randomised trial; The Lancet; vol 356, December 2000.

24. Mansoor N Bangash, Ming-Li Kong, Rupert M Pearse: Use of inotropes and vasopressor agents in critically ill patients; William Harvey Research Institute, Barts and The London School of Medicine and Dentistry, London , UK .
25. Endre Zima , Dimitrios Farmakis , PieroPollesello, et. Al.: Differential effects of inotropes and inodilators on renal function in acute cardiac care; European Heart Journal Supplements; 2022, D12- D19.
26. Russell J, Walley K, Singer J, et al.: Vasopressin versus norepinephrine infusion in patients with septic shock; N Engl J Med; 2008;358:877-87.
27. DeBacker D, Biston P, Devriendt J, et al.:Comparison of dopamine and norepinephrine in the treatment of shock; N Engl J Med; 2010;362:779-89
28. Peter Elliot: "Rational use of Inotropes" Multiple effect of Inotropes; Cardiac Anaesthesia. September 2006. Vol 7, p.326-30.
29. Joe Kanter, Peter DeBlieux: "Pressors and Inotropes" Hemodynamic effect;Emerg Med Clin N Am 32 ; 2014, P.823-34.
30. cardiac intensive care unit at a tertiary care hospital; Drug Invention Today; 2018, vol 10 issue 2.
31. Russel J Roberts, Todd A Miano, Drayton A Hammond, et. Al.: Evaluation of Vasopressor Exposure and Mortality in Patients With Septic Shock; Crit Care Med.; October 2020
32. Sahithya Ravali Ravula and Visalakshi Kancheria: A study on the pattern of Inotropes use in an Intensive care unit; Journal of International Pharmaceutical Research; 2019, vol 20
33. Steven M Hollenberg: "Vasopressor support in septic shock" Chest; November 2007; 132(5), 1678-87.
34. Jacob C Jentzer , Steven M Hollenberg, et. Al.: Vasopressor and Inotrope Threapy in cardiac critical care; Journal of Intensive care medicine; Aug 2021; vol 36 issue 8, p.843-56
35. Rhodes A, Evans LE, Alhazzani W, et al.: Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 201; Intensive Care Med. 2017;43(3):304-77.
36. Marinosci GZ, De Robertis E, De Benedictis G, et. Al.: Dopamine Use in Intensive Care: Are We Ready to Turn it Down? Transl Med UniSa.; 2012;4:90-4.
37. Fuchs L, Chronaki CE, Park S, et. al.: ICU admission characteristics and mortality rates among elderly and very elderly patients. Intensive Care Med 2012;38(10):1654e61.
38. Koponen T, Karttunen J, Musialowicz T,et.al.: Vasoactive-inotropic score and the prediction of morbidity and mortality after cardiac surgery; *Br J Anaesth*. 2019;122(4):428-36.
39. Dünser M, Hjortrup P, Petilla V: Vasopressors in shock: are we meeting our € target and do we really understand what we are aiming at? Intensive Care Med 2016;42:1176
40. D'Aragon F, Belley-Cote EP, Meade MO, et. al.: Blood pressure targets for vasopressor therapy: a systematic review. Shock 2015;43(6):53
41. Lamontagne F, Richards-Belle A, Thomas K, et. al.: Effect of reduced exposure to vasopressors on 90-day mortality in older critically ill patients with vasodilatory hypotension: a randomized clinical trial; J Am Med Assoc; 2020;323(10):938

	***Priyansha Jain – Corresponding Author*** Doctor of Pharmacy- Intern, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001
	***Sobhan Gupta*** Doctor of Pharmacy- Intern, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001
Image *Author -3*	***Luv Kumar*** Doctor of Pharmacy- Intern, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001
Image *Author -4*	***Dr.Prolay Paul*** Clinical Pharmacologist Narayana Superspeciality Hospital, Howrah, West Bengal-711103. AMC Co-Ordinator, NCC, PvPI, Ghaziabad
Image *Author -5*	***Dr.Piyush MIttal*** Professor & Head of Department of Pharmacy Practice, Teerthankar Mahaveer College of Pharmacy, Moradabad, U.P-244001