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Original Research Paper

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EXPLORATION OF MEDICATION TRENDS IN THE MANAGEMENT OF METABOLIC DISEASES: A CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL IN MANDYA

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ABSTRACT

Background: Metabolic diseases such as type 2 diabetes mellitus (T2DM), hypertension (HTN), and dyslipidemia are rising globally and are frequently associated with multimorbidity, requiring individualized and evidence-based pharmacotherapy. Understanding real-world prescribing trends helps identify practice patterns and opportunities for optimization. **Objective:** To evaluate the prescribing trends of medications in the management of metabolic diseases in a tertiary care setting. **Methodology:** A cross-sectional study was conducted over six months in the Department of General Medicine, Mandya Institute of Medical Sciences. A total of 204 inpatients diagnosed with one or more metabolic diseases were enrolled using convenience sampling. Data were collected through structured case report forms and analyzed using descriptive statistics and Chi square tests to assess associations between disease combinations and prescribing practices. **Results:** The study population had a mean age of 59.52 ± 14.31 years, with females (59.8%) more represented than males (40.2%). Uncontrolled T2DM was the most frequent diagnosis (10.7%), commonly coexisting with hypertension (8.8%) and acute gastroenteritis (7.8%). The most frequently prescribed drugs were Ranitidine (8.4%), Ceftriaxone (7.6%), Atorvastatin (5.0%), Amlodipine (4.5%), and Paracetamol (4.4%). Antidiabetic therapy included Metformin, Glimepiride, and insulin (Human Actrapid, Mixtard), while antihypertensives (Amlodipine, Telmisartan, Enalapril) were widely used. Aspirin and Atorvastatin were commonly prescribed for cardiovascular risk reduction. Polypharmacy was highly prevalent, with 82.8% of patients receiving 5–9 drugs and a mean of 7.2 ± 1.83 drugs per patient. Chi-square analysis showed significant associations between specific disease combinations and prescribing patterns, reflecting rational, condition-specific therapy. **Conclusion:** The study highlights the predominance of multimorbidity, polypharmacy, and reliance on a few commonly prescribed agents in managing metabolic diseases. Prescribing patterns adhered to standard therapeutic guidelines, yet the high drug burden emphasizes the need for regular prescription review, patient education, and individualized therapy to optimize outcomes and reduce medication-related risks.

KEYWORDS : Metabolic diseases, prescribing trends, type 2 diabetes mellitus, hypertension.

INTRODUCTION

Metabolic disorders are a heterogeneous group of chronic diseases characterized by disturbances in the metabolism of carbohydrates, lipids and proteins, which leads to an impaired metabolic homeostasis and progressive organ dysfunction. Metabolic disorders including type 2 diabetes mellitus (T2DM), hypertension, obesity, dyslipidemia, metabolic syndrome, and chronic kidney disease (CKD) are frequently co-exist due to common pathophysiological pathways such as insulin resis-tance, chronic low-grade inflammation, oxidative stress, and endothelial dysfunction thereby increasing the risk of cardiovascular disease, renal deterioration, and premature death [1,2].

The Global burden of metabolic diseases has increased substantially over the past two decades owing to rapid urbanization, population aging, unhealthy dietary habits, physical inactivity and sedentary lifestyles. The Global Burden of Disease (GBD) study estimates that metabolic disorders represent a substantial proportion of disability-adjusted life years (DALYs) and mortality and are projected to increase further in the coming decades, particularly in low and middle-income countries[3]. Similarly, India is experiencing a rapid epidemiological transition. The prevalence of diabetes, hypertension, generalized obesity, abdominal obesity and dyslipidemia as reported in the ICMR - INDIAB study was 11.4%, 35.5%, 28.6%, 39.5% and 81.2% respectively underscoring the growing burden of metabolic diseases and the associated healthcare challenges[4].

The presence of several metabolic diseases often requires long-term combination pharmacotherapy. This is associated with a higher risk of polypharmacy, adverse drug reactions, drug-related problems, poor medication adherence and increased healthcare costs. Drug utilization studies serve as valuable tools for the evaluation of prescribing practices, the assessment of adherence to evidence - based guidelines and the identification of opportunities for improving the quality and rationality of patient care[5].

Previous studies have primarily focused on prescribing patterns for individual metabolic diseases such as diabetes mellitus and chronic kidney disease and has documented differences in drug use and suboptimal adherence to recommended treatment guidelines[6]. However, compre-hensive evidence describing medication utilization across the spectrum of metabolic diseases in tertiary care setting remains limited, particularly in South India. This is an important research gap, since patients with metabolic diseases often present with several concomitant diseases that require integrated pharmacological management rather than disease-specific treatment. therefore, the present study was undertaken to study the medication trends in the management of metabolic diseases in patients attending a tertiary care hospital in Mandya. The findings may provide valuable evidence regarding current prescribing practices and support strategies to promote rational drug use and optimize patient outcomes.

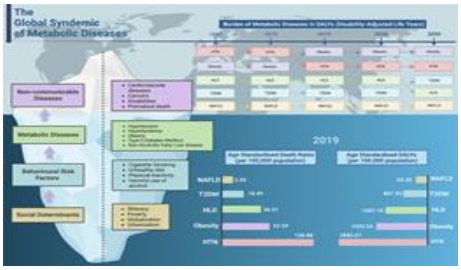

Figure 1: Global Burden and Epidemiology of Major Metabolic Diseases

MATERIALS AND METHODOLOGY

A Hospital-based cross-sectional study was conducted in the Department of General Medicine, Mandya Institute of Medical Sciences (MIMS), Mandya, Karnataka for a period of six months after obtaining approval from the Institutional Ethics Committee. The study included adult patients diag-nosed with one or more metabolic diseases (type 2 diabetes mellitus, hypertension, dyslipidemia, obesity, metabolic syndrome or chronic kidney disease) and receiving phar-macological treatment. A convenience sample of patients admitted to the General Medicine ward who provided written informed consent were enrolled. Pregnant or lactating women were excluded from the study. The sample size was calculated by using the standard formula for prevalence, with an assumed prevalence of 50% and a margin of error of 7% which resulted in a minimum sample size of 204 participants. Demographic characteristics (age, gender), clinical parameters (blood pressure, HbA1c, and lipid profile), diagnosis of metabolic diseases, medication details (drug name, dose, frequency and duration of therapy) were collected through a structured case record form. The collected data were analysed to evaluate the medication use pattern and prescribing trends among patients with metabolic diseases. Data were entered into Microsoft Excel and analysed using Python version 3.12.11 (Google Colab; GCC 11.4.0). Descriptive statistics including frequencies, percentages, means and standard deviations were used to summarize the data. Welch's t-test was used for compare continuous variables. The association of metabolic disease and prescribed drugs was analyzed by Chi-square test. The p-value was <0.05 and was considered statistically significant. The results have been presented in tables and graphical formats.

Ethical approval: The study protocol was approved by the Institutional Ethics Committee, Mandya Institute of Medical Sciences, Mandya (IEC No. MIMS/IEC/2025/1029). Written informed consent was obtained from all study participants prior to enrolment.

RESULTS AND DISCUSSION

A hospital-based cross-sectional study was conducted in the Department of General Medicine, Mandya Institute of Medical Sciences (MIMS), Mandya, over a period of six months to evaluate medication utilization patterns in patients with metabolic diseases. A total of 204 patients who fulfilled the predefined inclusion criteria were enrolled in the study. Demographic characteristics, disease profiles, prescribing patterns, and polypharmacy indicators were analysed to assess medication trends in the management of metabolic diseases. The results and their clinical implications are presented and discussed under the following sections.

Demographic Characteristics

In the study population there was 204 patients of whom 122 (59.8%) were female and 82 (40.2%) were male, showing the predominance of the female patients in the study population. Most of the participants were in the age group of 60-69 years, followed by the age group 70-79 years and the least represented age group was 20-29 years. The mean age of study population was 59.52 ± 14.31 years. The mean age of female patients (61.48 ± 14.12 years) was significantly higher than that of male patients (56.61 ± 14.18 years) (Welch's t-test,t-value= -2.407, p = 0.017). This suggests a significant age difference between the two groups.

Table 1: Age and Gender Distribution of Study Participants

Age (Years)	Male		Female		Total
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	
20-29	1	0.5	2	1.0	3
30-39	8	3.9	7	3.4	15
40-49	17	8.3	18	8.8	35
50-59	20	9.8	17	8.3	37
60-69	20	9.8	35	17.2	55
70-79	10	4.9	32	15.7	42
80-89	6	2.9	9	4.4	15
90-99	0	0.0	2	1.0	2
Total	82	40.2 %	122	59.8%	204

Distribution of Disease Combinations

Table 2. Distribution of Top 10 Disease Combinations in the Study population. The most common disease condition was uncontrolled type 2 diabetes mellitus (T2DM) in 22 (10.7%) of 204 individuals. This was followed by hypertension (HTN) with uncontrolled T2DM in 18 (8.8%) and uncontrolled T2DM with acute gastroenteritis (GE) in 16 (7.8%). Other frequently observed disease combinations were hypertension and type 2 diabetes mellitus and acute gastroenteritis (9 patients; 4.4%), hypertensive urgency (9 patients; 4.4%), hypertensive emergency with seizures (7 patients; 3.4%), hypertension and type 2 diabetes mellitus and chronic obstructive pulmonary disease (7 patients; 3.4%), hypertension alone (7 patients; 3.4%), type 2 diabetes mellitus and pneumonia (7 patients; 3.4%) and hypertensive emergency and pulmonary edema (6 patients; 2.9%). The most common clinical presentations in this study were uncontrolled diabetes mellitus and hypertension, alone or in combination with acute medical conditions in the study population.

Table 2: Top 10 Disease Combinations Among Patients with Metabolic Diseases (n=204)

Disease combinations	Total number of patients (n)	Percentage (%)
Uncontrolled T2DM	22	10.7
HTN, Uncontrolled T2DM	18	8.8
Uncontrolled T2DM, Acute GE	16	7.8
HTN, T2DM, Acute GE	9	4.4
HTN Urgency	9	4.4
HTN emergency, Seizure	7	3.4
HTN, T2DM, COPD	7	3.4
HTN	7	3.4
T2DM, Pneumonia	7	3.4
HTN emergency, Pulmonary edema	6	2.9

Overall Medication utilization pattern

A total of 1,469 medications were prescribed to 204 patients included in the study. Table 3 shows the prescribing frequency of the top 10 medications. Most commonly prescribed drugs were Ranitidine (123 prescriptions; 8.37%), followed by Ceftriaxone (111; 7.56%), Atorvastatin (74; 5.04%), Amlodipine (66; 4.49%) and paracetamol (65; 4.42%). Other commonly prescribed medications were normal saline (53; 3.61%), metformin + glimepiride (53; 3.61%), aspirin (51; 3.47%), furosemide (51; 3.47%) and human Actrapid insulin (47; 3.20%) . These drugs were the most widely used drugs in the treatment of patients with metabolic diseases. Conversely, some drugs such as dobutamine, apixaban, nitroglycerin, ticagrelor, vitamin K, and Caripill were used infrequently (<1%) based on their prescription in specific clinical scenarios.

The predominance of gastroprotective agents, broad-spectrum antibiotics, antihypertensive agents, antidiabetic agents and lipid lowering drugs, reflects the complex therapeutic needs of patients suffering from metabolic diseases admitted in a tertiary care hospital. The high rate of prescribing ranitidine and ceftriaxone may be attributed to the management of acute gastrointestinal conditions and infectious complications, while atorvastatin, amlodipine, metformin, and insulin preparations were prescribed according to the management of cardiovascular risk factors, hypertension and diabetes mellitus. These results indicate that the medication utilization was primarily aimed at management of both the chronic metabolic diseases and the acute complications related to them.

Table 3: Overall Medication Utilization Pattern Among the Study Population (n=204)

Drugs	Number of Prescription (n)	Percentage (%)
Ranitidine	123	8.37
Ceftriaxone	111	7.56
Metformin	31	2.11
Atorvastatin	74	5.04
Amlodipine	66	4.49
Paracetamol	65	4.42
Normal saline	53	3.61
Metformin +Glimepiride	53	3.61
Aspirin	51	3.47
Furosemide	51	3.47

Medication Utilization Pattern in the Top 5 Disease Combinations

The pattern of medication utilization in the top five disease combinations is presented in Table 4. Insulin preparations were frequently prescribed in patients with uncontrolled type 2 diabetes mellitus (T2DM) (n = 22). These included Human Actrapid (72.7%), Human Mixtard (36.4%), metformin, ceftriaxone, ranitidine and intravenous fluids, indicating the need for intensive glycaemic control and supportive management.

In patients with hypertension (HTN) and uncontrolled T2DM (n = 18), insulin therapy was frequently used concomitantly with metformin, glimepiride, amlodipine, telmisartan and enalapril, indicating concurrent management of diabetes and hypertension. Supportive medications such as ceftriaxone and ranitidine were also often administered.

An integrated approach towards glycaemic control, infection management and correction of dehydration was shown in patients with uncontrolled T2DM and acute gastroenteritis (GE) (n=16) predominantly received ceftriaxone, ondansetron, pantoprazole, Human Actrapid, intravenous fluids and metformin.

Commonly prescribed medications for patients with HTN, T2DM and acute GE (n = 9) were ondansetron, atorvastatin, metformin, ceftriaxone, clopidogrel, and telmisartan, which reflecting the simultaneous management of metabolic disorders and acute gastroenteritis simultaneously.

Similarly, hypertensive urgency patients (n = 9) were commonly prescribed atorvastatin, enalapril, labetalol, furosemide, and amlodipine, indicating a focus on blood pressure control and cardiovascular risk reduction.

The overall prescribing pattern in the 5 most common disease combinations suggested use of disease-specific pharmacotherapy with adjunctive medication for manage-ment of acute complications. The major therapeutic classes prescribed were antidiabetic agents, antihypertensive drugs, antibiotics, gastroprotective agents, intravenous fluids and cardiovascular medications, which reflecting the complexity of the management of patients with multiple metabolic disorders in a tertiary care hospital.

Table 4:predominantly Prescribed Medications Among the top Five Disease Combinations

Disease Combinations	Predominantly Prescribed Medications
Uncontrolled T2DM	Inj. Human Actrapid (16; 72.7%) IVF. NS (15; 68.2), Inj. Ceftriaxone (14; 63.6), Inj. Ranitidine (14; 63.6) T. Metformin (11; 50.0) Inj. Mixtard (8; 36.4)
Uncontrolled T2DM, Acute Gastroenteritis	Inj. Ceftriaxone (16; 100%) Inj. Ondansetron (12; 75.0%) Inj. Pantoprazole (10; 62.5%) Inj. Human Actrapid (10; 62.5%) T. Metformin (5; 31.2%)
HTN with Uncontrolled T2DM	Inj Ranitidine (13; 72.2%) Inj Ceftriaxone (13.72.2%) T. Metformin (12; 66.7%) T. Amlodipine (9; 50.0%) T. Glimepiride (9; 50.0%) Inj. PCT (6; 33.3%) T. Telmisartan (6; 33.3%)
HTN, T2DM, Acute Gastroenteritis	Inj. Ondansatron (8; 88.9%) T. Atorvastatin (6; 66.7%) T. Metformin (5; 55.6%) Inj. Ceftriaxone (5; 55.6%) T. Clopidogrel (5; 55.6%) T. Telmisartan (4; 44.6%) Inj. Pantoprazole (4; 44.6%) T. Glimepiride (4; 44.6%)
Hypertensive Urgency	T. Atorvastatin (8; 88.9%) T. Enalapril (7; 77.8%) Inj. Labetolol (6; 66.7%) Inj Furosemide (5; 55.6%) T. Amlodipine (4; 44.4%) Neb. Duolin + Budecort (4, 44.4%) T. Bisoprolol (3; 33.3%) T. Clopidogrel (3; 33.3%)

Polypharmacy Pattern

The distribution of patients according to the number of drugs prescribed is shown in Table 5. The mean number of medications prescribed per patient was 7.2 ± 1.83. The majority of patients received 7 medications (25.0%), 6 medications (24.5%), and 8 medications (16.2%), indicating a high prevalence of multiple drug therapy in patients with metabolic diseases. Only 10 (4.9%) patients were on less than five medications while 25 (12.3%) patients were on ten or more medications.

Based on the classification of polypharmacy, 169 (82.8%) patients had polypharmacy (5–9 medications), and 25 (12.3%) patients had excessive polypharmacy (≥10 medications). The present study found a high prevalence of polypharmacy, which is consistent with the presence of multiple metabolic disorders and associated comorbidities that necessitate the use of multiple therapeutic agents to obtain adequate disease control. However, increased medication burden may also increase the risk of adverse drug reactions, drug–drug interactions, medication non-adherence and higher healthcare costs emphasizing the importance of regular medication review and rational prescribing practices in patients with multimorbidity.

Table 5: Polypharmacy Pattern Among the Study Population (n=204)

Polypharmacy Category	Patients (n)	Percentage (%)
<5 (No polypharmacy)	10	4.9
5-9 (Polypharmacy)	169	82.8
≥ (Excessive polypharmacy)	25	12.3

Association Between Disease Combinations and Prescribing Pattern (Chi-square test)

The association between the top five disease combinations and prescribed medications was assessed using the Chi-square test, and only statistically significant associations ($p<0.05$) were included. The important associations are summarized in Table 6. Significant associations of patients with uncontrolled T2DM were observed with Human Actrapid insulin, intravenous normal saline, Ringer's lactate, and furosemide, indicating management of hyperglycaemia and associated clinical complications. Similarly, HTN with uncontrolled T2DM was significantly associated with Metformin, glimepiride, telmisartan, intravenous dextrose , and paracetamol, suggesting concurrent pharmacologic management of diabetes and hypertension.

A significant association was found between ceftriaxone, ondansetron, ranitidine, human actrapid insulin, furosemide, atorvastatin, amlodipine in patients with uncontrolled T2DM and acute gastroenteritis. A significant association was found

between telmisartan, metronidazole, ondansetron, sporolac, ramipril in patients with HTN, T2DM and acute gastroenteritis. In Hypertensive urgency patients there were significant associations with enalapril, labetalol, atorvastatin, bisoprolol, ceftriaxone, ranitidine, betahistine and apixaban. These results indicate that the underlying combinations of diseases had a significant influence on the prescribing patterns and that individualised pharmacotherapy was used for the management of chronic metabolic disorders and their acute clinical conditions.

Table 6: Significant Drug Association with Top Five Disease Combination (chi-square Test, P<0.05)

Disease combination	Drugs significant associated (p<0.05)
Uncontrolled T2DM	Inj. Furosemide (0.0092) Inj. H. Actrapid(0.0000) IVF NS (0.000) IVF RL (0.0004)
HTN, Uncontrolled T2DM	IVF Dextrose (0.0411) T. Telmisartan (0.0376) Inj. PCT (0.0298) T. Metformin(0.0403) T. Glimepiride (0.0314)
Uncontrolled T2DM, Acute GE	Inj. Ceftriaxone (0.0004) Inj. Ranitidine (0.0011) Inj. Furosemide (0.0353) Inj. PCT (0.0124) Inj.H.Actrapid 0.0003) T. Amlodipine (0.0092) Inj.Ondansetron (0.0000) T. Sporolac (0.0000) T. Doxycycline(0.0000)
HTN,T2DM,Acute GE	T. Telmisartan (0.0302) T. Sporolac 0.0072) Inj. Metronidazole (0.0072) Inj. Ondansetron (0.000) T. Ramipril (0.0001)
HTN Urgency	Inj. Ceftriaxone (0.0200) Inj. Labetalol (0.0000) T. Betahistine (0.0011) Inj. Bisoprolol (0.0000) T. Enalapril (0.0000) T. Atorvastatin (0.0027) T. Apixaban (0.0261)

The findings of the chi- square analysis should be interpreted with caution. The chi-square test identifies associations between disease combination and prescribing patterns but does not establish causality. In addition, small cell frequencies for certain diseases - drug combinations may have influenced the reliability of some statistical results. Further-more ,only statistically significant associations (p <0.05) were high-lighted in the present study ; however, non significant associations may still have clinical relevance in routine practice and should not be disregarded.

CONCLUSIONS

This hospital-based cross-sectional study provides an insight into the pattern of medication utilization among the patients with metabolic diseases admitted to tertiary care hospitals. The most frequent clinical presentations were uncontrolled uncontrolled type 2 diabetes mellitus and hypertension alone or in combination with acute medical conditions ,illustrating the rising burden of multimorbidity among patients with metabolic disorders. The most frequently prescribed drugs were antibiotics, gastroprotective agents and supportive medi-cations, indicating evidence- based management of chronic diseases and their acute complications. There was a very high rate of polypharmacy. Reflecting the complex pharmacological management in the population of patients. There were significant associations between disease combinations and prescribing patterns, which further indicated that the choice of medication was tailored to the patient's clinical conditions. Overall, the findings provide useful real- world evidence on prescribing trends and underscore the importance of rational prescribing, periodic medication review and diligent monitoring of polypharmacy to optimize therapeutics outcomes and minimise medication-related risks in patient with metabolic diseases, further studies with larger sample sizes in multicenter settings are warranted to validate the findings and support the development of standardized prescribing strategies.

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