Polypharmacy and comorbidity status in the treatment of type 2 diabetic patients attending a tertiary care hospital: An observational and questionnaire-based study

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Abstract

Purpose/Aim: Diabetes mellitus is associated with several comorbid conditions. Thus, often, diabetic patients are prescribed multiple drugs. Although multiple drugs help to combat various diseases, they also increase the propensity of drug interactions and adverse drug reactions. The present study thus tried to evaluate the comorbid conditions and concurrent medications associated with type 2 diabetic patients. It also aimed to address patient compliance for the medications provided to them.

Materials and Methods: This was a cross-sectional observational study conducted for 2 months – January–February 2017. Data were collected from prescriptions of the patients and also by interviewing the willing patients, attending the Diabetic Clinic of R. G. Kar Medical College, Kolkata, India.

Results: During the study period, 150 patients were interviewed and their prescriptions were studied. Out of 150 patients, 69 (46%) were males and 81 (54%) were females. The mean age of the study population was 51.5 (±0.78) years. The present study evaluated that 83.3% (125) of the study population suffered from at least one comorbid conditions, the most common being hyperlipidemia (70.7%) and hypertension (47.3%). The average number of drugs prescribed is 4.72 (±0.11) per prescription. Metformin was prescribed to 96% of the patients. The concurrent medications recommended included hypolipidemics (72%), antihypertensives (68%), drugs for peptic ulcer (34.7%), and antiplatelets (10.7%).

Conclusion: The present study thus concluded that diabetic patients suffer from a number of comorbid conditions, most commonly, cardiovascular problems. The comorbidity increased with the age. The level of polypharmacy was also high, thereby increasing the pill burden for the patients.

Keywords: Cardiovascular disorders, comorbidity, diabetes mellitus, hypolipidemics, polypharmacy

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INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorder, resulting in hyperglycemia. It occurs due to lack of insulin hormone or insensitivity of cells to insulin, causing increased blood sugar level. There are two types of DM: type 1 caused by absolute insulin deficiency and type 2 caused by insulin resistance due to defective responsiveness of insulin receptors. Long-term damage of vital organs

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such as kidney, heart, nerves, blood vessels, and eyes results from chronic effect of diabetes.[1] A study performed with 110 countries across the world revealed 366 million people affected with DM in 2011 and this number is expected to increase to 552 million by 2030.[2]

DM is associated with various comorbid conditions such as hypertension, hyperlipidemia, and cardiovascular disorders.[1] Study of prescriptions of diabetic patients from various parts of the world suggests that antihypertensives, antihyperlipidemics, and antiplatelets are often coprescribed along with the antidiabetics. Hypertension or elevated blood arterial pressure affects about 70% of diabetic patients and the risk of development of hypertension is twice for diabetic patients compared to euglycemic individuals.[3] It was observed from a study in California that 41.5% of diabetic patients coprescribed with at least one antihypertensives.[4] Dyslipidemia is often associated with diabetes and is found to increase risk of cardiovascular disorders. Hypolipidemics, mainly statins, are thus prescribed to reduce the risk of cardiovascular problems. A study in 2013 in Gujarat, India, showed 15.41% were prescribed hypolipidemic drug atorvastatin.[5] Observational study in Germany and North Carolina highlighted 25.5% and 37.7% of the diabetic patients were prescribed at least one statin, respectively.[6,7] Platelets are involved in the process of development of thrombus and are thus engaged in blood clotting. Platelets thus play a key role in the development of atherogenesis (fat deposition of the artery walls), thereby causing blockage of the arteries and increasing the risk of ischemia. Thus, inclusion of antiplatelet therapy in diabetic patient is essential to reduce the chances of ischemia.[8] An observational study in Gujarat, India, revealed 18.9% of the diabetic population was prescribed aspirin.[5]

Thus, prescription studies from all around the world suggested that a diabetic patient is burdened with a number of medicines. Polypharmacy, that is, the use of multiple medicines by a single patient, is an integral part of diabetic patients. Studies in various parts of the world report that polypharmacy is becoming prevalent in therapy, especially among older adults.[9] A survey conducted in different countries on the number of medicines per prescription revealed several countries including India practice the use of three or more medicines per prescription. A survey conducted in the United States indicated 25% of population takes more than five medicines per week.[10] The use of multiple drugs has some advantages including synergistic effects. However, the possibility of adverse drug reactions and drug-drug interactions cannot be ruled out altogether. Study from Kuopio, Finland, between 1998 and 2003, showed excessive polypharmacy associated with mortality in elderly patients.[11]

Multiple drug therapy is apparently beneficial but with advancement of science, it is important to evaluate its burden and real effectiveness. The present study tried to estimate the correlation of polypharmacy with comorbidity in diabetic patients. This study also addressed the lifestyle and compliance of the diabetic patients. However, very few studies are known, especially in the eastern part of India, that encompasses so many factors related to diabetes. Therefore, it justified the rationality and importance of the present study in global aspect.

MATERIALS AND METHODS

Study type
This study was a cross-sectional, questionnaire-based study.

Study duration
The study was conducted for a period of 2 months – January–February 2017.

Place of study
The study was conducted from the Diabetic Clinic of R. G. Kar Medical College, Kolkata.

Study population
Patients attending the diabetic clinic were included in the study provided they meet the inclusion criteria and were willing to participate.

Inclusion criteria
- Patients attending the diabetic clinic for at least 3 months
- Patients suffering from type 2 diabetes
- Genders: Both (male and female)
- Patients, willing to participate in the study and signed the informed consent
- Patients receiving at least one antidiabetic drug, prescribed by the physicians in the Diabetic Clinic, R. G. Kar Medical College, Kolkata.

Exclusion criteria
- Patients who were pregnant and lactating/nursing a child
- Unwilling patients.

Ethical clearance
Ethical clearance was obtained from Institutional Ethics Committee, R. G. Kar Medical College, Kolkata (Reference No. RKC/5438 dated 14.12.2016).

Study design
This was a cross-sectional, questionnaire-based observational study. The study was conducted on

patients attending the Diabetic Clinic of R. G. Kar Medical College, Kolkata, meeting the inclusion criteria and willing to sign the informed consent. Prescription of the patients was documented for data collections. Researchers also interviewed the patients to fill up the questionnaire. Patients' age, sex, comorbid conditions, concomitant medications, and level of polypharmacy were assessed in the present study. Apart from these, family history, lifestyle of the patient, and patient compliance were also considered. The data were collected for data analysis.

RESULTS

During the study period, 150 patients were interviewed and their prescription studied. Out of 150 patients, 69 (46%) were males and 81 (54%) were females.

Age of the patients in the study population ranged from 27 years to 77 years. The mean age of the study population was 51.5 (±0.78) years. About 38.7% (58) of the patients belonged to the age group of 41–50 years, and it was followed by 31.3% (47) in the age group of 51–60 years, as shown in Figure 1. The mode and median of the age distribution were 45 years and 50 years, respectively.

About 42% (63) of the patients in the study population claimed that they had diabetes in their family, however, 52.7% (79) patients claimed that neither parents nor siblings had a history of diabetes [Table 1]. About 89.3% (134) patients claimed that they were nonvegetarian in their food habits. Twenty-seven (18%) of the study population were smokers and 9 (6%) consumed alcohol occasionally, as shown in Table 1.

DM patients suffer from various comorbid conditions. The present study revealed 70.7% (106) of the patients suffered from hyperlipidemia, 47.3% (71) of the patients suffered from hypertension, 11.3% (17) patients had several other cardiovascular problems, as evident from Figure 2. Patients
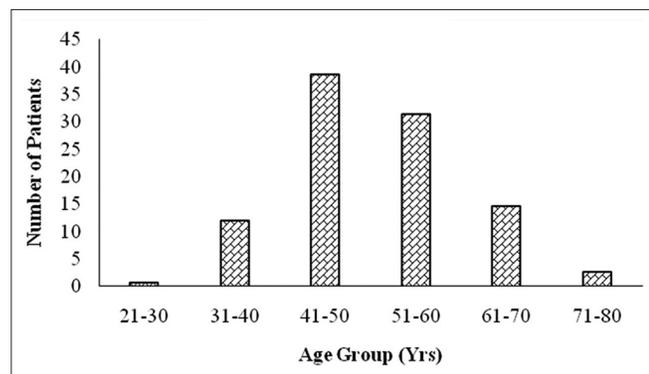
suffered from at an average of 1.43 (±0.074) comorbid conditions.

Figure 3 represented the level of comorbidity in relation to age of patients. It was observed that with increase in age of the patients, the comorbidity increased. The mean comorbid condition for the age group 31–40 years was 0.8 (±0.2) whereas for the age group 71–80 years, it was 2 (±0.4). Thus, the present study revealed elderly patients suffering from type 2 DM had a greater propensity of suffering from related disorders such as cardiovascular problems and renal disorders.

The antidiabetic drugs most commonly prescribed to the type 2 diabetic patients included metformin in 96% (144), followed by glimepiride 49.3% (74), linagliptin 44% (66), and vildagliptin 40% (60). Apart from antidiabetics, various other classes of medications were coprescribed. The average number of drugs prescribed is 4.72 (±0.11) per prescription. As shown in Figure 4, the different classes of concomitant medications used included hypolipidemics (72%, 108), antihypertensives (68%, 102), drugs for peptic ulcer (34.7%, 52), antiplatelets (10.7%, 16), vitamins and mineral supplements (7.3%, 11), nervous system drugs (6.7%, 10), thyroid therapy (2.7%, 4), urologics (2%, 3), anti-inflammatory drugs (1.3%, 2), and antibacterials (1.3%, 2).

The present study revealed that the level of polypharmacy increased with the age of the patients. Figure 5 showed that

Table 1: Details of family history, food habit, and lifestyle of patients in the study population (*n*=150)

Variables	Response		
Family History of Diabetes	Yes (%)	No (%)	Don't Know (%)
	63 (42)	79 (52.7)	8 (5.3)
Food habit	Vegetarian (%)	Non-vegetarian (%)	
	16 (10.7)	134 (89.3)	
Cigarette Smoking	Yes (%)	No (%)	
	27 (18)	123 (82)	
Alcohol Drinking	Yes (%)	No (%)	
	9 (6)	141 (94)	

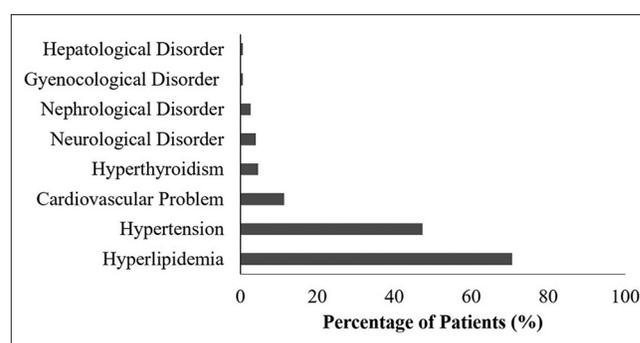**Figure 1:** Distribution of study population according to age (*n* = 150)

Figure 2: Distribution of various comorbid conditions in the study population (*n* = 150)

the maximum level of polypharmacy was 5.82 (±0.36) in the age group of 61–70 years.

Patient compliance to the prescribed drugs in the present study revealed 59.3% (89) of the study population complained of musculoskeletal disorders that include joint pains and fatigue. About 48% (72) of the patients complained of gastrointestinal disorders, whereas 8% (12) suffered from nervous system disorders. The use of over-the-counter (OTC) drugs, without proper medical advice, is a common practice among the patients that often results in various adverse events. The present study revealed that the most commonly used OTC drugs were drugs for peptic ulcer (24%, 36) and anti-inflammatory drugs (14.7%, 22). Along with modern medicines, use of alternative medications is a recent trend in the society. The present study estimated that 10.7% (16) of the patients consumed homeopathic medicine, and 6% (9) patients had ayurvedic drugs parallel to these synthetic drugs.

DISCUSSION

DM is a disease of improper metabolism of carbohydrate, proteins, and fat. Diabetes is associated with various other complications such as cardiovascular problems, nephrological, and neurological problems. Thus, very often, diabetic patients are compelled to prescribe a number of medications. Polypharmacy or the use of multiple medicines for a single patient not only increases the pill burden for the patient but also aggravates the chance of drug-drug and drug-food interactions. The present study was designed to evaluate the comorbid conditions and concomitant medications of the patients attending the diabetic clinic of the tertiary care hospital. Out of 150 patients, 69 (46%) were males and 81 (54%) were females. Similar study in Gujarat, India, depicted 50.4% were males and 49.6% were females.[5] A study in Nepal estimated 59.59% were males and 43.41% were females.[12] Thus, the present study revealed the prevalence of diabetes among females as compared to the previous studies. The mean age of the study population was 51.5 (±0.78) years. The mean age of the male population was 55.5 (±1.14) years, and that of the females was 48.1 (±0.96) years. Study in Gujarat revealed that age of the males was 59.49 (±8.79) years and that of the females was 56.31 (±9.71) years.[5] These mean ages were slightly greater than that obtained from the present study. About 38.7% (58) of the patients in the present study belonged to the age group of 41–50 years, whereas a study in Nepal revealed 37.91% of the patients belonged to the age group of 51–60 years.[12]
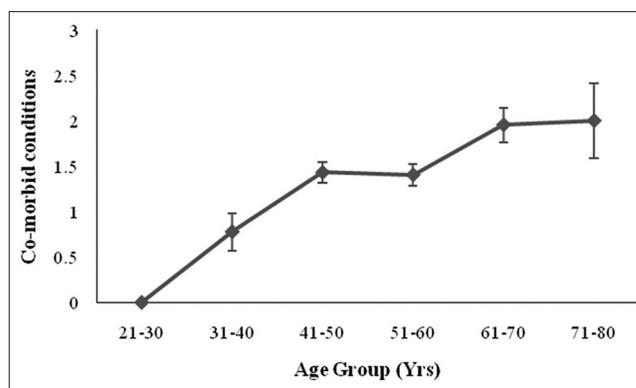

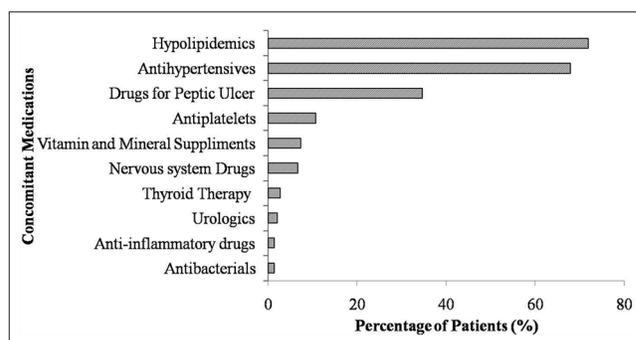**Figure 3:** Distribution of comorbidity in relation to age of the patients of the study population (*n* = 150)

Figure 4: Distribution of concomitant medications in patients of the study population (*n* = 150)
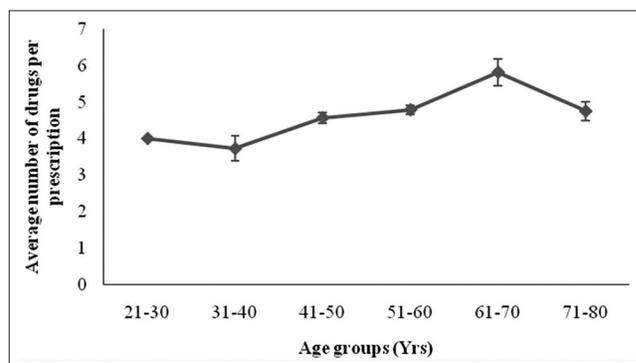

Figure 5: Distribution of level of polypharmacy in relation to age of the study population (*n* = 150)

The present study evaluated that 83.3% (125) of the study population suffered from at least one comorbid conditions—the most common being hyperlipidemia (70.7%) and hypertension (47.3%). The study in Nepal, however, estimated about 74.72% of the diabetic patients had at least one concurrent illness.[12] Both hyperlipidemia and hypertension increase the propensity of cardiovascular disorders among diabetic patients. Researches showed that around 80% of the diabetic patients die because of cardiovascular disorders.[13] As shown in Figure 3, the mean number of comorbid conditions increased with the age of

the patient. Thus, it can be predicted that elderly patients suffer more from various concomitant disorders and thus are prescribed a number of drugs.

The present study revealed that number of drugs per prescription ranged from 2 to 9 drugs. The average number of drugs prescribed was 4.72 (±0.11) per prescription. Similar study in Gujarat revealed that the mean number of drugs was 5.56 ± 2.52.[5] However, similar study in Tamil Nadu estimated that the mean number of drugs was 3.3 ± 1.33.[14] A study in Ahmedabad, India, reported that an average of 5 drugs per prescription was recommended to patients suffering from serious adverse effects.[15] From the present study, it was also evident that level of polypharmacy increased with age of the patients. The maximum level of polypharmacy was 5.82 (±0.36) in the age group of 61–70 years.

Metformin was the choice of drug for 96% of the study population that was in accordance with studies conducted in Gujarat and Nepal.[5,12] The other concurrent medications prescribed along with antidiabetics included hypolipidemics (72%, 108), antihypertensives (68%, 102), drugs for peptic ulcer (34.7%, 52), and antiplatelets (10.7%, 16). The present study also evidenced that atorvastatin was the choice of hypolipidemic drug used in all the patients of the study population.

According to the recommendations of American Diabetes Association, the target fasting glucose values range from 80 to 130 mg/dl, and peak postprandial levels are targeted at <180 mg/dl. Therefore, levels of fasting blood glucose >130 mg/dl and postprandial level >180 mg/dl are considered as having poor control.[16] Based on this definition, the present study revealed that 40.7% (61) of the patients had uncontrolled diabetes.

It is true that literature studies in various parts of the world suggested that diabetes is associated with various comorbid diseases and requires concomitant medications. However, among 91 million people residing in West Bengal, the prevalence of diabetes is quite high, about 12% in Kolkata and 13% in Howrah.[17] Despite the high prevalence of diabetes in West Bengal, this type of study is very few in West Bengal, eastern part of India. Moreover, drug safety and efficacy are dependent on a number of factors including genetic variability of an individual. Thus, therapeutic success of fixed-dose combinations depends on a number of factors including the quality of formulation, maintenance of storage, drug distribution, set up, rational prescribing, and proper use of drug by patients. The present study thus tried to evaluate the level

of comorbidity and polypharmacy among diabetic patients in this tertiary care hospital. This is a rational, justified, and timely approach to refine the therapy of DM in this part of the world.

CONCLUSION

Polypharmacy indicates concomitant use of a number of drugs. In this complex scenario of therapeutics, especially for diseases such as diabetes, the exact burden and nature of polypharmacy on the society on different aspects including cost-effectiveness, is very important. The present study was a step to evaluate this complex scenario. The present study established the relation of age with comorbidity in diabetic patients. The mean comorbid conditions for the age group 31–40 years were 0.8 whereas of 71–80 years was 2. Another important information obtained from the present study highlighted the maximum level of polypharmacy (5.82) was prevalent in the geriatric age group of 61–70 years. However, astonishingly, it failed to support the correlation of smoking and drinking with diabetes. Therefore, reducing pill burden and yet providing maximum benefit to the patients is of utmost importance. More research on the pharmacokinetics and pharmacodynamics of appropriate and scientific fixed drug combinations is needed.

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Conflicts of interest
There are no conflicts of interest.

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