WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 3, 1336-1345. Research Article ISSN 2277– 7105

IMPACT OF CLINICAL PHARMACIST ACTIVITIES IN IMPROVING GLYCEMIC CONTROL OF TYPE 2 DIABETES MELLITUS PATIENTS WITH INFECTIOUS DISEASES

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Article Received on 14Jan. 2020,
Revised on 04 Feb. 2020,
Accepted on 24 Feb. 2020
DOI: 10.20959/wjpr20203-16948

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ABSTRACT

Introduction: Infections are a major clinical challenge for type 2 diabetes patients, but little is known about the impact of glycemic control. In general, infectious diseases are more frequent and/or serious in patients with diabetes mellitus, which potentially increases their morbidity and mortality. The relationship between hyperglycemia and infection appears to be bidirectional and inter-dependent. The purpose of this study is to evaluate the impact of clinical pharmacist activities in improving glycemic control of non-critically ill type 2 diabetic patients admitted to the hospital with various infections. **Methodology:** This is a prospective interventional study that divided patients into Group I and Group II. The patients in Group I were monitored for blood glucose levels and in Group II patients received clinical pharmacist activities and monitored for blood glucose levels. The mean RBS, FBS and PPBS of patients in both the groups were compared. **Results:** Among the clinical pharmacist activities in group II, patient counseling was effective for 77% of patients, drug interactions in 13% and ADRs in 10% of patients. At discharge, normoglycemia patients were predominant in group II (73.3%) than group I. Clinical pharmacist participation in glycemic control is effective by reducing the fasting and postprandial blood glucose with a mean difference of 11.02mg/dl and 29.40mg/dl ($p < 0.05$) respectively. **Conclusion:** There was a positive impact of clinical pharmacist activities in controlling blood glucose levels of type 2 DM patients admitted with infections. This suggested that the active participation of clinical pharmacists in glycemic

control along with other health care professionals is effective and safe. Hence a collaborative team is essential for the management of hyperglycemia in internal wards.

KEYWORDS: Hyperglycemia, infections, management, the role of Clinical Pharmacist.

INTRODUCTION

Diabetes mellitus is a noted cause of morbidity and mortality world over. Globally, the number of people with diabetes mellitus has quadrupled in the past three decades, and diabetes mellitus is the ninth major cause of death. The latest estimates show that there was a global prevalence of 425 million people with diabetes in 2017, which is expected to rise to 629 million by 2045.[1] About 1 in 11 adults worldwide now have diabetes mellitus, 90% of whom have type 2 diabetes mellitus (Type 2 DM).[2]

As a consequence of hyperglycemia of diabetes, every tissue and organ of the body undergoes biochemical and structural alterations which account for the major complications in diabetes which may be acute metabolic or chronic systemic.[3]

Infections are a major clinical challenge for type 2 diabetes patients, but little is known about the impact of glycemic control. Patients with diabetes tend to be hospitalized for infections more frequently than those without.[4] In general, infectious diseases are more frequent and/or serious in patients with diabetes mellitus, which potentially increases their morbidity and mortality. The relationship between hyperglycemia and infection appears to be bidirectional and inter-dependent.[2] The presence of hyperglycemia has been demonstrated to be associated with an increased risk of infection in critically as well as non-critically ill patients.[2] This is due to the result of suppressing immune functions by hyperglycemia secondary to impaired phagocytosis, diminished production of oxygen radicals from neutrophils and chemotaxis.[5] Often the infection is a prominent stress condition that has been known to be associated with hyperglycemia through an increased level of counter-regulatory hormones (e.g. cortisol, epinephrine, glucagon), activation of the inflammatory cascade, and oxidative stress.[2]

Infections are a major clinical challenge and a common cause of death.[6] Type 2 DM patients have a 1.5 to 3 fold increased risk of primary care treated infections, particularly hospital-treated infections, compared with the general population, but the exact mechanisms linking diabetes and infections are not well understood.[7]

The incidence rates of community-treated and hospital-treated infections were lowest at HbA1c values of 5.50%–7.49% and increase monotonically with increasing HbA1c levels. For every 1% increase in the latest updated HbA1c value, the rate of community-treated infection increased by 3% and the rate of hospital-treated infection increased by 6%. An association with risk of infection was observed, particularly for HbA1c values of 8.50% or higher, reaching adjusted hazard ratios of 1.19 for community-treated infection and 1.64 for hospital-treated infection in patients with HbA1clevels greater than or equal to 10.50% as compared with 5.50%–6.49%.[8] In this regard, infectious diseases especially pneumonia and urinary tract infections account for 20% to 55% of all precipitating causes of hyperglycaemic crises.[9]

Current guidelines recommend target blood glucose levels from 140 – 180 mg/dl and not more strict target (80 – 110 mg/dl) or liberal range (180 to 196 mmol/l).[10]

Patient education is a keystone of optimal therapy of diabetes. When patient education is conducted effectively, this will lead to more involvement of the patient in their care, better self-management and improved adherence.[5] The active involvement of pharmacists, especially clinical pharmacists, in the glycemic control of hospitalized patients has reduced the length of hospital stay, the rate of hyperglycemia, as well as hypoglycaemic events.[11]

Patients with diabetes are at higher risk for moderate or severe infection-related morbidity caused by altered defense mechanisms, including the effects of hyperglycemia, obesity, the effects of neuropathy, impaired tissue perfusion on injury and wound healing. Alternatively, individuals with diabetes have a similar incidence of infection but a higher case-fatality rate from serious infections caused by altered host defenses and/or the increased presence of underlying disorders that predispose mortality. Hence diabetes is a strong predictor of mortality related to infection; the relationship between diabetes and infection-related mortality was independent of coexisting heart disease at baseline and other diabetes-related comorbidities. Poor glycemic control is powerfully associated with serious infections and should be a high priority.

Although medication therapy has a successful impact on glycemic control but adhering to the treatment, knowledge on the correct use of the drugs and lifestyle modifications are difficult for patients. More than half of patients are estimated to have inadequate adherence either to drug therapy or recommended diet which may lead to suboptimal therapeutic goals and

increased hospitalization with complications. Suboptimal therapeutic goals are witnessed despite regular patient care. So there is a need for special monitoring in this aspect which may be done by clinical pharmacists, who trained to educate the patients about the disease and medications.

Many studies have been published on the role of the pharmacist in controlling blood glucose. But only a few studies have been published on clinical pharmacist activities in controlling dysglycemia and have not been specifically assessed in non-critically ill patients with different infectious diseases.

The purpose of this study is to find out the impact of clinical pharmacist activities in improving glycemic control of type 2 DM patients admitted to the hospital with various infections.

METHODOLOGY

This is a hospital-based prospective interventional study conducted during a period of 8 months in the In-patient general medicine department of a 1000 bedded tertiary care hospital in Karimnagar, Telangana.

The study protocol was approved by the Institutional Ethics Committee (IEC) of the hospital. A structured data collection form was used to collect the data from the patient profile. Non-critically ill type 2 diabetic patients with poor glycemic control admitted to the general medicine department with any infection were included in the study and in general, patients with other classes of diabetes like type 1 diabetes, gestational diabetes and diabetes due to underlying disease were excluded from the study. Also type 2 DM patients admitted with any infections to the general medicine department with normal blood glucose levels, patients with co-morbidity of cancer, critically ill patients admitted in Intensive Care Unit (ICU), the patients who are not willing to participate in this study were also excluded.

Based on the inclusion and exclusion criteria, the patients were selected and randomly divided into group I (control) and group II (subjected to clinical pharmacist activities/treatment group).

Instructions were given both group I and group II. Additionally in group II, the lifestyle of the patient, adherence, administration techniques of insulin, use of oral hypoglycaemic agents was collected and necessary corrections were made. Also, group II patients were assessed for

improvement in glycemic control after providing clinical pharmacist activities. And all the details will be kept confidential.

The significant differences in the mean of RBS, FBS and PPBS were calculated using unpaired student *t*-test in the software Graphpad Prism 8.0.2 (263).

RESULTS

Table 1 summarises the demographic and clinical characteristics of the patients involved in the study. Table 2 compares blood glucose levels of patients in both groups. Table 3 shows a brief idea of the clinical pharmacist activities that affected the blood glucose levels of patients in group II.

Table 1: Demographic and clinical characteristics of the patients involved in the study.

VARIABLES	GROUP I (n=75)	GROUP II (n=75)
AGE (mean) in years	52.28	51.43
Gender (%)		
Male	65.3	65.3
Female	34.6	34.6
Duration of DM (mean) in years	7.12	5.29
Final diagnosis (%)		
Skin and soft tissue infections	14.6	24
Tuberculosis	5.3	5.3
Urinary tract infections	16	12
Gastro-intestinal tract infections	5.3	2.6
Malaria	4	4
Sepsis	4	6.6
Pneumonia	8	6.6
Dengue	29.3	17.3
Viral pyrexia	13.3	21.3
Treatment in hospital		
Monotherapy with OHA	14.6	13.3
Combination therapy with OHA	13.3	17.3
Insulin	72	65.3
OHA + insulin	0	4
Length of hospital stay (mean) days	7.1	6.99

Glycemic status at discharge (%)		
Hyperglycemia	50.6	26.6
Normoglycemia	49.3	73.3

Table 2: Comparison of mean RBS, FBS and PPBS of the patients in Group I and Group II.

GLYCEMIC STATUS	GROUP I	GROUP II	MEAN DIFFERENCE (GROUP I-GROUP II)	P-VALUE
RBS	273.57	271.56	2.01±18.63	0.4571
FBS	200.25	187.30	11.21±10.53	0.1444
PPBS	260.10	227.69	29.40±10.97	0.0041*

* - p-value is less than 0.05.

Table 3: Number of clinical pharmacist activities (n %) in group II.

PATIENT EDUCATION	ADVERSE DRUG REACTIONS	DRUG INTERACTIONS
58 (77)	7 (9.3)	10 (13)

DISCUSSION

Diabetes is a disease that desperately needs more clinical pharmacist involvement. Pharmacists who are specialized in this growing chronic condition can make a significant, positive impact on the patient, the health care system and themselves. Pharmaceutical care and the expanded role of pharmacists are associated with many positive diabetes-related outcomes, including improved clinical measures, improved patient and provider satisfaction, and improved cost management.[12]

Several studies supported the favorable effect of the pharmacist-led, multidisciplinary team in managing diabetes in different settings.

Many studies were published on the role of clinical pharmacists in controlling blood glucose levels but only a few studies were conducted on the involvement of clinical pharmacists in managing blood glucose specifically in infectious diseases.[4]

In this study, the patient's RBS, FBS and PPBS were obtained and the mean was taken. The mean random blood sugar of Group I patients was 273.57mg/dl, mean fasting blood sugar was 200.22mg/dl, and postprandial blood sugar was 259.58mg/dl. In the patients of Group II,

the mean RBS was 271.56mg/dl, FBS was 189.01mg/dl and PPBS was 230.19mg/dl. The random blood sugar was collected on the day of admission in the hospital. Since all the patients in the study were admitted with hyperglycemia, there was no significant difference in the RBS ($p = 0.4571$) values in both groups. FBS values can be controlled by the use of basal-bolus insulin therapy. But, it is common in internal wards of a hospital to follow sliding scale insulin as their treatment for uncontrolled DM. Due to the use of sliding scale insulin regimen, the FBS values were not significant in our study. The mean difference of fasting blood glucose was found to be 11.02 with the p-value of 0.1444 and the mean difference of PPBS was 29.40 with the p-value of 0.041* ($p < 0.05$). The reduction in the mean FBS and PPBS indicated the improved glycemic control in Group II patients. HbA1c test was not checked in the in-patient department in most of the patients and so it was not included in our study.

The results were consistent with the study of Farsaei *et al*. published in 2014, evaluated the impact of the role of the pharmacist in controlling dysglycemia in infectious disease patients in pre and post-intervention groups. They found that the percentage of controlled random blood sugar increased from 13.8% in the pre-intervention to 22.3% in the post-intervention group. On the other hand, the percentage of controlled fasting blood sugars in the post-intervention group was non-significantly higher than in the pre-intervention group.[5] In a study by Forough *et al*. FBG had a significant decline after patient education from 161.7 ± 12.5 to 147.3 ± 13.1 mg/dL.[14] The standard medical care given by the American Diabetes Association suggested the collaborative management team is essential to provide adequate diabetes management and development of various aspects of glycemic control.[2]

The treatment used during the hospital stay and discharge for controlling hyperglycemia did not differ much in both groups and the treatment was given were as per the guidelines followed in the hospital. This is in resemblance to the study of Farsaei which revealed the same treatment options opted for both control and intervention groups.[4]

In this study, the clinical pharmacist activities like past medical history interview were taken and patient counseling was given to all the patients in Group II. Information about the disease was delivered to all the patients regardless of their knowledge and understanding of the disease. Their knowledge of medications and lifestyle modifications was assessed and the relevant information to the patient was provided. The information that made an impact on their glycemic control was noted and follow up was made till the discharge of the patients, to

know whether they used the information to control their glucose levels and whether they achieved their glucose control. By reviewing the medical chart of the patient, few patients had hyperglycemia due to the use of certain drugs which were identified as adverse drug reactions (ADRs) and in some hyperglycemia resulted as a consequence of the use of two drugs (drug interactions). The queries asked by patients were provided immediately or within one day but the number of queries asked the clinical pharmacist was not in a significant number (data not shown). Adherence was insisted on the patients who were irregular in their medications and others were encouraged to continue the same. Advice on physical activities was given based on the patient's background. The patients using insulin injection regularly were evaluated on their knowledge of handling and administration of insulin and the corrections were given where necessary.

The activities that effected blood glucose levels were found to be patient counseling in 77% of the patients in Group II, followed by drug interactions in 13% and ADRs in 10% of the patients in Group II. These activities has lead to predominant normoglycemia during discharge in Group II patients (73.3%) than Group I. It was consistent with the study of Jehnani *et al*. on effectiveness of patient education on glycemic control in insulin-treated patients, they found that the HbA1c of the patients decreased from the baseline value of 8.8% +/- 1.23 to 7.6 +/- 1.43 with an increase in the prevalence of satisfactory HbA1c (< or = 8%) from 33% to 61.2%. Hence the study concluded education led to an improvement in diabetes control in insulin treated diabetic patients. More attention should be paid to such strategies in general practice.[16]

Diabetes has enhanced susceptibility to various infections such as tuberculosis, pneumonia, pyelonephritis, otitis, carbuncles and diabetic ulcers. This could be due to various factors such as impaired leucocyte function, reduced cellular immunity, and poor blood supply due to vascular involvement. The different infectious diseases observed in the patients of Group I of this study reveal that dengue (29.4%). But in Group II, skin/soft tissue infections (21%). During this study period, the prevalence of dengue was higher in this region. DM patients in the study had decreased knowledge on foot care and hygiene. Hence more number of dengue were included in Group I of the study whereas skin/soft tissue infections were higher in Group II The findings in Group I was in contrast and Group II was consistent with the study of Farsaei *et al.* since it consists of skin/soft tissue infections were higher than other diseases in pre and post interventional groups.[5]

CONCLUSION

The result of the current study showed a positive impact of clinical pharmacist activities in controlling blood glucose levels of non-critically ill type 2 DM patients admitted with infections. This suggested that the active participation of clinical pharmacists in glycemic control along with other health care professionals is effective and safe. Hence a collaborative team is essential for the management of hyperglycemia for non-critically ill patients with infectious diseases admitted in the hospital.

REFERENCES

1. Forouhi NG, Wareham NJ. Epidemiology of diabetes, Medicine, 2010; 1.38(11): 602-6.
2. American Diabetes Association. Standards of medical care in diabetes--2012. Diabetes care, 2012; 35: S11.
3. Harsh Mohan. The endocrine system. In: Praveen Mohan, editor. Textbook of Pathophysiology, New Delhi, Jaypee Brothers Medical publications, 2015; 11: 477-92.
4. Abu-Ashour W, Twells L, Valcour J, Randell A, Donnan J, Howse P, Gamble JM. The association between diabetes mellitus and incident infections: a systematic review and meta-analysis of observational studies. BMJ Open Diabetes Research and Care, 2017; 1.5(1): e000336.
5. Farsaei S, Karimzadeh I, Elyasi S, Hatamkhani S, Khalili H. Glycemic control in the infectious diseases ward; role of clinical pharmacist interventions. The Journal of Infection in Developing Countries, 2014; 15.8(04): 480-9.
6. Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. Physical therapy, 2008; 1.88(11): 1254-64.
7. Shah BR, Hux JE. Quantifying the risk of infectious diseases for people with diabetes. Diabetes care, 2003; 1.26(2): 510-3.
8. Mor A, Dekkers OM, Nielsen JS, Beck-Nielsen H, Sørensen HT, Thomsen RW. Impact of glycemic control on risk of infections in patients with type 2 diabetes: a population-based cohort study. American journal of epidemiology, 2017; 15.186(2): 227-36.
9. Brenner ZR. Management of hyperglycemic emergencies. AACN advanced critical care, 2006; 17(1): 56-65.
10. Godinjak A, Iglica A, Burekovic A, Jusufovic S, Ajanovic A, Tancica I, Kukuljac A. Hyperglycemia in critically ill patients: management and prognosis. Medical Archives, 2015; 69(3): 157.

11. Schmeltz LR, De Santis AJ, Thiyagarajan V, Schmidt K, O'Shea-Mahler E, Johnson D, Henske J, McCarthy PM, Gleason TG, McGee EC, Molitch ME. Reduction of surgical mortality and morbidity in diabetic patients undergoing cardiac surgery with a combined intravenous and subcutaneous insulin glucose management strategy. Diabetes care, 2007 1.30(4): 823-8.
12. Sriram S, Chack LE, Ramasamy R, Ghasemi A, Ravi TK, Sabzghabaee AM. Impact of pharmaceutical care on quality of life in patients with type 2 diabetes mellitus. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences., 201; 16: S412.
13. Farsaei S, Sabzghabaee AM, Zargarzadeh AH, Amini M. Effect of pharmacist-led patient education on glycemic control of type 2 diabetics: a randomized controlled trial. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences, 2011; 16(1): 43.
14. Forough AS, Esfahani PR. Impact of pharmacist intervention on appropriate insulin pen use in older patients with type 2 diabetes mellitus in a rural area in Iran. Journal of research in pharmacy practice, 2017; 6(2): 114.
15. Mularski KS, Yeh CP, Bains JK, Mosen DM, Hill AK, Mularski RA. Pharmacist glycemic control team improves quality of glycemic control in surgical patients with perioperative dysglycemia. The Permanente Journal, 2012; 16(1): 28.
16. Jenhani M, Gaha K, Nabouli R, Ghedira A, Abdelaziz AB. Effectiveness of patient education on glycemic control in insulin treated patients in general practice. Diabetes & metabolism, 2005; 1.31(4): 376-81.