Diabetic care delivery with package of essential noncommunicable diseases interventions protocol in rural Nepal: A district hospital-based study

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ABSTRACT

Background: Diabetes ranks fourth among the noncommunicable diseases (NCDs) in terms of proportional mortality in Nepal and is increasingly diagnosed in rural population. We aimed to evaluate the care delivery in diabetes patients in a rural primary care hospital that had implemented the World Health Organization’s Package of essential NCDs interventions (PEN) protocol.

Subjects and Methods: This was a descriptive study in a rural district hospital. The study was conducted over 5 months and was undertaken as a part of the quality improvement project in the hospital. Data were extracted from the electronic medical record of the hospital after approval from hospital administration.

Results: The total diabetic patient visits during the study period were 682 of 30,758 total outpatient visits (2%). There were 240 unique diabetic patients. The age ranged from 25 to 82 years with the median age of 52. Glycated hemoglobin was done in 15 of 59 new cases and in 33 of 181 follow-up cases. Urine protein was assessed in 65 of 240 patients. Comorbidities and complications were documented in 96 of 240 patients (40%), hypertension being the most common. Fifty-six patients (23%) had obtained control as per the target levels with different modalities of treatment, 69 (29%) had partial control, 85 (35%) struggled to reach targets, and 30 (13%) failed to appear in follow-up visits.

Conclusion: The study described our adherence to the PEN protocol and identified several areas of improvement in our diabetes care delivery such as continuous medical education activities and monitoring of care delivery with similar study in future after implementation of proposed interventions.

Keywords: Diabetes, essential medicines, package of essential noncommunicable diseases protocol, primary care, rural

Introduction

Nepal is a developing country where rural communities constitute 80% of the total population.[1] With changing lifestyles, urban influence, and improving health-care access, diabetes mellitus is increasingly diagnosed in rural population.[2,3] Diabetes ranks fourth among the noncommunicable diseases (NCDs) regarding proportional mortality in Nepal.[4] A meta-analysis suggested that the prevalence of diabetes in urban and rural communities is 8.1% and 1%, respectively.[5,6] Alarmed by the prevalence and impact of diabetes, Government of Nepal has endorsed the World Health Organization’s (WHO’s) Package of Essential NCDs (PENs) protocol in July 2016 to provide cost-effective interventions for screening and management of NCDs including diabetes.
in resource-limited health-care settings.[7] Bayalpata Hospital is a primary care district hospital which serves almost 300 patients per day in the outpatient department and has a catchment population of 150,000. The hospital has primary care physicians and health assistants work together to screen diabetes along with other NCDs in susceptible individuals and facilitate management. The health assistants examine, investigate, and prescribe medications and seek consultations with physicians on need basis. Health assistants are effective and cost-effective in mitigating the problem of health personnel shortage in rural community and in providing quality health care.[8,9] The hospital utilizes electronic medical record system to strengthen protocol-based care and possesses a robust team of community health workers to ensure regular patients' follow-ups in the hospital. The hospital has a formulary of around 300 drugs including metformin, glimepiride, and premixed 30:70 insulin as recommended by the PEN protocol and national list of essential medicines.[10,11] The study aimed to measure the burden of diabetes in the rural hospital setting, to evaluate the team efficiency in the care of diabetes patients, and to determine the sufficiency of therapeutic armamentarium.

**Subjects and Methods**

The study was carried out in the patients attending the Outpatient Department of Bayalpata hospital, located in one of the most rural settings in Nepal. It takes nearly 10 h to reach nearest multispecialty hospitals. This was a descriptive study and was undertaken as a part of quality improvement project for diabetes care. Data were collected from the electronic medical record system of the hospital for the duration of 5 months from November 1, 2017 to March 31, 2018. All the patients visiting the outpatient department and having the diagnosis of diabetes were enrolled in the study. Prior approval was obtained from the hospital administration for data extraction from its electronic medical record system.

We collected data of patients including gender; age; investigations such as fasting and postprandial plasma glucose levels, glycated hemoglobin (HbA1c), and urine protein; comorbidities; and medicines prescribed. In the institutional protocol, diabetes was diagnosed as per the American Diabetes Association (ADA) guidelines 2017 when (i) the patient was clinically symptomatic with random plasma glucose ≥200 mg/dl or (ii) the fasting plasma glucose was ≥126 mg/dl and 2-h postprandial plasma glucose was ≥200 mg/dl.[2] The classic symptoms of diabetes were polyuria, polydipsia, and unexplained weight loss. The new cases were described as cases diagnosed during the study period and the follow-up cases were the ones that were diagnosed before the study period. The outcomes after pharmacotherapy with available medications such as metformin, glimepiride, and insulin 30:70 were also evaluated in terms of control of plasma glucose on follow-up. The control of plasma glucose was assessed after at least two visits. The "control" of plasma glucose was termed when the fasting plasma glucose was 90–130 mg/dl and 2-h postprandial plasma glucose was <180 mg/dl. When only the fasting plasma glucose was under control, it was termed as "partial control" and if neither of the fasting nor postprandial plasma glucose was within expected range, the plasma glucose was termed as "not under control." Those cases that failed to follow-up during the last 2 months of the study were labeled as "failed to follow-up." The patients had to visit the hospital every month for refills of medications.

Data were analyzed using the Statistical Package for the Social Sciences version 21.0 (IBM Inc, Armonk, New York, USA) and Microsoft Excel 2013 (Microsoft Corporation, Redmond, Washington, USA). The categorical variables were reported in numbers and percentages. The Shapiro–Wilk test was used to test the normality of continuous variables. For normally distributed continuous variables, mean and standard deviation were used. Median and interquartile range were employed for the rest of the continuous variables. Chi-square test was used to compare differences in categorical variables. $P < 0.05$ was considered statistically significant.

**Results**

The total diabetic patient visits during the study period were 682 of 30,758 total outpatient visits (2%). However, there were 240 unique diabetic patients including new and follow-up cases. The new and follow-up patients were 59 (24.6%) and 181 (75.4%), respectively. Diabetes was observed more in males (187, 77.9%) than females (53, 22.1%) ($P = 0.000$). The age of the diabetes patients ranged from 25 to 82 years with the median age of 52 and interquartile range of 47–63. Diabetes was the most common in the age group of 41–50 years ($P = 0.000$) [Figure 1].

HbA1c was done in 15 of 59 new cases and ranged from 5.5% to 14%. The mean HbA1c at presentation was 8.9% ± 2.7%. Similarly, HbA1c was performed in 33 of
181 cases in follow-up. The median HbA1c in follow-up was 7.9% with an interquartile range of 6.8%–11%. Urine protein was assessed in 65 of 240 patients (27%). Out of this, 29 had proteinuria. Urine protein was reported trace, 1+, 2+, and 3+ in 13, 12, 2, and 2 patients, respectively.

Comorbidities and complications were documented in 96 of 240 patients (40%). Hypertension was the most common comorbid condition and was reported in 74 of 240 patients (31%). Similarly, hypothyroidism was documented in nine patients (4%), diabetic foot in seven patients (3%), chronic kidney disease in four patients (2%), coronary artery disease in two patients (1%), chronic respiratory disease in two patients (1%), and cerebrovascular disease in one patient.

Eighty-three of 240 patients (35%) were receiving only metformin. Glimepiride was a singular therapy in two patients (1%). One hundred and forty patients (58%) were prescribed both metformin and glimepiride. Five patients (2%) were using only insulin therapy. Similarly, five patients (2%) were provided with combination therapy of metformin and insulin and five patients (2%) were treated with lifestyle modifications. Fifty-six patients (23%) had obtained control as per the target levels with different modalities of treatment, 69 (29%) had partial control, 85 (35%) struggled to reach targets, and 30 (13%) failed to appear in follow-up visits [Figure 2]. There was no significant difference in glycemic control with respect to gender differences (P = 0.748).

Twenty-six of 240 patients (10%) had a prescription of antiplatelet agent, acetylsalicylic acid (aspirin) and statin, and atorvastatin, whereas 14 (6%) and 30 (13%) had received only aspirin and only atorvastatin, respectively. Angiotensin-converting enzyme (ACE) inhibitor, enalapril was prescribed in 11 of 29 patients with proteinuria (38%). Out of these, six cases had trace proteinuria, and five had 1+ proteinuria.

Discussion

The study showed that the diabetes patients’ visits constituted 2% of total outpatient visits in our district hospital. Since this was a hospital-based study, the actual prevalence of diabetes in the rural community could not be reflected given the limitation of awareness of symptoms of diabetes and access to health facility regarding the availability of mode of transportation and its costs. A study in rural population in Nepal suggested the prevalence of diabetes was around 7%. Our study concluded that there was male predominance among diabetes patients (77.9% vs. 22.1%, P < 0.05). The finding was similar to other study performed in hospital setting in Nepal (63.8% vs. 36.2%). However, another study from India in inpatient setting suggested otherwise, with female predominance (46% vs. 54%). Further studies in community level would be helpful to clarify the gender differences in diabetes. The age ranged from 25 to 82 years. In the absence of advanced laboratory investigations in the district hospital setting, it was difficult to differentiate type of diabetes. Yet, the study underpinned the need to screen diabetes in young individuals even in rural setting.

Diabetes is a known risk factor for chronic kidney disease. Moreover, it becomes essential to screen each diabetes patient in primary care to screen for proteinuria and prevent the progression of chronic kidney disease to end-stage renal disease requiring hemodialysis or renal transplant. Our study showed that 45% of those evaluated had some degree of proteinuria. A study from primary care centers in the United Kingdom indicated that the prevalence of proteinuria was 8.6% of all diabetes patients, whereas another hospital-based study from Nepal showed the prevalence of 49%. A community-based screening in Eastern Nepal revealed that 14.5% of diabetes patients had proteinuria. The difference could be explained by the efficacy of primary health-care centers in developed
countries in early screening and management of diabetes which was not possible in the developing world. In rural settings, the patients usually present late during the course of diabetes and suffer from late complications including nephropathy. Measuring HbA1c levels is recommended at least every 6 months.[2] Most of the district hospitals lack such facility. Utilization of investigation depends on the availability and practice of health-care provider. Our study revealed underutilization of HbA1c testing in the hospital and demonstrated the need to reorient health-care providers on diabetes laboratory investigation modalities available in the hospital.

Diabetes is a chronic disorder, and hence, it is likely that patients of diabetes develop other conditions during diabetes. About 40% of diabetes patients had one or more comorbidities. The most common comorbidity reported was hypertension (31%) followed by hypothyroidism (4%), diabetic foot (3%), chronic kidney disease (2%), coronary artery disease (1%), chronic respiratory disease (1%), and cerebrovascular disease (0.5%). Diabetes and hypertension share similar risk factors and are likely to coexist.[6] Pokharel et al. reported that 41% of their diabetes patients had hypertension.[13] On the other hand, another study from Nepal in the outpatient department in a tertiary care center concluded that 25.3% of diabetes patients had comorbid hypertension.[17] Maskey et al. concluded that 4% of their diabetes patients had hypothyroidism.[18] The prevalence of diabetic foot was 8% in a study from the United Kingdom and 14% in another study from India.[19,20] Neuropathy and diabetic eye diseases were never diagnosed and reported in our study. This finding indicated the need to train both physicians and health assistants in sensory examination and direct ophthalmoscopy to recognize these conditions in diabetes patients. Neuropathy screening could help in the early management of diabetic foot. The findings of diabetic eye disease, including cataract and retinopathy, might help prevent fall injuries and surgical interventions thereafter.

We analyzed our institutional performance in achieving target levels as per the ADA guidelines using the WHO’s PEN protocol which was designed for resource-limited health-care settings like ours. We discovered that 2% were treated with lifestyle modification counseling and were observed for follow-up. This reflected that our health-care providers were aware of the importance of lifestyle modifications in diabetes. About 93% of our patients were treated with metformin alone or in combination with glimepiride. This exhibited our adherence to the ADA guidelines and PEN protocol to start monotherapy with metformin whenever possible and add another agent if target levels were not achieved. The health-care providers prescribed insulin alone or in combination in 4% of the patients. While 35% had trouble achieving target levels with different modalities including insulin, it seemed necessary to increase our insulin usage and to understand the restraints in prescribing insulin. The fear factor of patients with injectable agents, the storage of insulin, the availability and disposal of needles, and the literacy factor required to administer prescribed quantity of insulin might discourage the use of insulin by both the providers and the patients.[21] About 13% failed to follow-up which could be due to the migration of patients, social stigma with chronic medication usage, and death.

Both aspirin and statin have been recommended for primary prevention in diabetes with at least one additional risk factor for atherosclerotic cardiovascular disease.[2] In this study, 29% were prescribed either one of these two agents or both. This finding advocated the need to motivate care providers in the evaluation of atherosclerotic risk factors and thereby enhance prescribing aspirin and statin to improve cardiovascular morbidity and to internalize the notion of prevention in primary care setting. Further, proteinuria in diabetes patients heralds diabetic nephropathy and subsequent progression to chronic kidney disease. Diabetic nephropathy accounts for 20%–40% of end-stage renal disease and creates additional economic burden. ACE inhibitors, such as enalapril, have indispensable role to retard the progression of diabetic nephropathy to end-stage renal disease especially in the presence of hypertension or albuminuria.[2] ADA recommends the urinary albumin-to-creatinine ratio to decide for prescribing ACE inhibitors. Since this is not usually feasible in our rural setting, we decided to analyze ACE inhibitors with qualitative estimation of urine protein. This study recommended the necessity to strengthen the knowledge and practice of ACE inhibitors for high-risk diabetes patients in our team of health-care providers. In a nutshell, implementing the PEN protocol only is a beginning to address the rising burden of NCDs in primary care, and it is also equally important that continuing medical education (CME) activities focused on NCDs are carried out in certain time intervals and quality improvement projects, similar to this study are undertaken to evaluate the effectiveness of interventions so that necessary protocols be developed and implemented.

**Conclusion**

We studied diabetes care in a rural hospital functioning with mixed cohort of health-care providers consisting
both physicians and health assistants. The hospital had utilized electronic health record system with a robust cohort of community health workers and had implemented the PEN protocol. The study similar to this as a part of quality improvement project should be advocated as an essential tool for measuring institutional performance and impact and enhance health-care delivery. The study revealed our adherence to the PEN protocol and identified scopes of improvement for quality care of diabetes. The study reflected the need of regular CME programs on diabetes and provide secondary prophylaxis for cardiovascular morbidity and diabetic kidney disease.

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**Conflicts of interest**
There are no conflicts of interest.

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