Original article

“Does cost of care influence the glycemic control, psychosocial illness and quality of care among adolescents with type 1 diabetes?: A hospital based cross section study in Mysuru, Karnataka

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ABSTRACT

Context: Type-1 Diabetes Mellitus, “a poor cousin of Type-2 Diabetes”, is the third commonest pediatric endocrine disease. On an average three new cases of T1DM/100,000 adolescents of 0–14 years are reported from India annually.

Objective: To find out the relationship between cost of care and glycemic control, psychosocial illness and quality of life among adolescent with type -1 diabetes.

Methods: This cross sectional study was conducted in a tertiary care hospital in Mysore for a period of 6 months. Adolescents in the age group of 11–19 years with T1DM who were on treatment for at least one year were included. Direct and indirect cost incurred in diabetes management was collected from receipts. Glycemic control was assessed with fasting, postprandial blood sugar and HbA1C levels in last 3 investigations. Psychosocial illness was assessed by DSM-5 (Diagnostic and Statistical Measure – 5) criteria and quality of life was assessed using Health related quality of life questionnaire for Diabetics.

Results: Among 50 subjects of type-1 diabetes included in the study, median annual cost of care was 25,758/- and of this 90.9% direct and 9.1% was indirect cost. There was a negative correlation between cost of care and glycemic control. The spending on diabetes care was lower among the subjects with psychosocial illnesses. The quality of life was poor among subjects who spend less on diabetes care.

Conclusion: There was a negative correlation between cost of care and glycemic control. Lower cost of care was associated with high burden of psychosocial illness and poor quality of life.

1. Introduction

Type-1 Diabetes Mellitus, “still a poor cousin of Type-2 Diabetes Mellitus (T2DM)”, is the third commonest pediatric endocrine disease. T1DM probably accounts for 5–10% of all diagnosed diabetes. About 40–60% of persons with T1DM are younger than 20 years of age at the onset, thus making diabetes one of the most common chronic diseases of childhood. The worldwide prevalence of T1DM is 0.1–0.3%, with 78,000 new cases every year, especially among young individuals (< 5 years).

According to International Diabetic Federation (IDF), India accounts for most of the adolescents with T1DM in South-East Asia. On an average three new cases of T1DM/100,000 adolescents of 0–14 years are reported from our country annually. Health care seeking is directly proportionate to the expenditure. The average annual expenditure of T1DM cases attending the specialty centre is quite high averaging from 54 USD to 224 USD. The expenditure further increases if the patients are hospitalized or undergo surgeries. As majority of health care expenses in India are out of pocket, diabetes further deteriorates person’s economic status.

The cost incurred in treatment of diabetes has direct relationship with glycemic control among children. Variation in glycemic control, feel of being economic burden to the family, need of adaptation to the diabetic lifestyle, stigma attached to the illness, feel of differentiation may lead to variety of psycho-social problems among these children.

Poor glycemic control, family and school problems, low socio-economic status, ethnicity, sex, and lack of adequate health insurance have been reported to increase risk of acute complications in children.

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with type 1 diabetes.\textsuperscript{6,7}

The adolescents with longer-established DM diagnoses had a worse Health-Related Quality of Life (HRQOL). The correlation of the lower satisfaction of the adolescents with a longer time since diagnosis suggests that the course of the disease is an important factor in the deterioration of QOL.\textsuperscript{8} The spending on diabetes care determines the clinical outcomes and complications associated with the disease which intern has major influence on quality of life among subjects with type 1 diabetes.\textsuperscript{9}

Thus there appears to be a relationship between cost of care, glycemic control, psychosocial illness and quality of life among adolescents with type 1 diabetes. There are very few studies available in the literature which explore this complex relationship, in this background the study was conducted to assess the interaction between glycemic control and cost of care among adolescents with type 1 Diabetes.

2. Subjects and methods

This cross sectional study was conducted in the Department of Community Medicine and Pediatrics, at JSS Medical College, Mysuru for a period of six months after obtaining approval from institutional ethics committee. With a reported prevalence of T1DM in Karnataka of 17.93/100000(0.0001793\%)\textsuperscript{1} with 1% relative allowable error and 95% confidence level, sample size calculated was 44.1 which was rounded off to 50. Adolescents in the age group of 11–19 years with Type 1 Diabetes who are on treatment for the period of at least one year and visiting the hospital were included in the study by consecutive sampling. Adolescents who were critically ill and the parents/primary care givers who are not willing to provide informed consent were excluded. Details regarding socio-demographic characteristics like age, gender, education, occupation of parents, educational status of parents, place of residence, socio-economic status and details regarding diabetes like age of onset, duration of diabetes, regularity of insulin administration, dietary practices, physical exercise, place of treatment, frequency of follow up visits, frequency of hospitalization were collected in a pre-tested structured performa by interviewing the parents of adolescents.

Glycemic status of the study subjects was assessed by most recent Glycosylated hemoglobin HbA1C levels and the average of last three fasting blood sugar and post-prandial blood sugar levels from the records of the study subjects.

Keeping 2018 as a base year cost incurred in the management of T1DM was assessed in two categories such as direct and indirect cost.

3. Assessment of direct cost

1. Monthly expenses on drugs, consultation and investigations were collected for last three months. Average for these items for the three months was calculated and extrapolated to one year by multiplying with four to get the annual costs.

2. Hospitalization costs were collected for all the hospital admissions in last one year directly through records from the parents.

4. Indirect costs

1. Transportation/conveyance expenses for monitoring visits, the daily wages of the primary care givers and secondary care givers lost during monitoring visits were collected for last three months, Average for these items for the three months was calculated and extrapolated to one year by multiplying with four to get the annual costs.

2. Transportation/conveyance expenses, the daily wages of the primary care givers and secondary care givers lost during hospitalizations were collected for all the episodes of hospitalization per subject in last one year.

Psycho social illness among the study subjects was assessed by a fifteen item DSM-5 (Diagnostic and Statistical Measure – 5) Parent/Guardian-Rated Level 1 Cross-Cutting Symptom Measure by interviewing the parents of the adolescents. This is a validated tool to assess the psycho-social illness among children.\textsuperscript{10}

Quality of life among study subjects was assessed using health related quality of life questionnaire for diabetics.\textsuperscript{11}

5. Statistical analysis

Data collected was entered in MS Excel: 2010 and analysed using SPSS version 23. Descriptive statistical measures like percentage, mean, median and standard deviation were applied. Normality of data was checked through Konglomerov Shernov test and non parametric tests Mann Whitney's test, Spearman's correlations were applied for the cost related data as it was not following normal distribution. The data was represented as tables and graphs as relevant. The correlation and differences were interpreted as statistically significant at $P < 0.05$.

6. Results

Among 50 subjects of type-1 diabetes included in the present study majority 29 (58.0\%) were in the age group of 11–15 years. There was equal representation of males and females and 20(40\%) of subjects were studying in high school. Majority of their fathers and mothers had studied up to high school. Fathers were laborer and mothers were housewives by occupation among majority of study subjects. 30 (60.0\%) were belonging to nuclear family, 28 (56.0\%) were hailing from urban areas and 17 (34.0\%) were belonging to lower middle socio economic status according to Modified B G Prasad's classification (Table 1).

Among 50 subjects included in the present study, majority 22 (44.0\%) had the onset of diabetes at their age between 6 and 10 years. 27 (54.0\%) had duration of diabetes for less than 5 years. Majority 27 (54.0\%) of subjects were very casual about diabetes diet and 7 (14.0\%) did not follow diabetes diet at all. 26 (52.0\%) were practicing regular physical exercise. 39 (78.0\%) used to take insulin twice a day. 38 (76.0\%) had uncontrolled diabetes (HbA1C levels > 7.5). (Table 2).

Average levels of HbA1C, Fasting blood sugar and Post prandial blood sugar were 9.5 ± 2.40, 172.2 ± 68.75 gms/dl and 262 ± 87.34 gms/dl respectively.

Overall annual median cost of care was 25,758/- and of this 90.9\% was direct cost and 9.1\% was indirect cost. The median annual direct expenditure was Rs. 23650/- only. Out of this, median cost incurred for consultancy was Rs. 450/- (0–1800), investigation was Rs. 1200/-, drugs (mainly insulin) was Rs. 500/- and hospitalization in last one year was Rs. 20,500/-. Frequency of consultations per year were ranging from 1 to 4. Coming to indirect cost, annual total indirect cost incurred was Rs. 2350/-. Out of this median cost incurred for transportation was Rs. 310/-. that of wages of primary care giver accompanying the patient to hospital was Rs. 900/-. (Table 3). Average days of loss of wages for hospitalization among primary care givers was 8.2 ± 5.3 days and for secondary care givers was 5.1 ± 1.2 days.

Majority of families of adolescents with Type 1 diabetes had compromised the health care of other family members due to excessive spending on the patients.

In the present study, 32\% of adolescents with type – 1 diabetes had one or the other psychosocial illness. Anger was found in 24% followed by sleep problems 20.0\% irritability 18\% and inattention 16\%.

There was a moderate negative correlation between cost related to consultation and HbA1C levels ($r = -0.577$, $P = 0.001$). Similarly moderate negative correlation was also observed between cost of investigations ($r = -0.588$, $P = 0.001$), cost of drugs ($r =$ -
The cost incurred for consultation, investigations, hospitalization and drugs was less among subjects with psycho-social problems compared to their normal counterparts (Table 5). The cost related to consultation, investigations and drug were relatively higher among subjects with good quality of life. On the other hand the cost of hospitalization was more among subjects with poor QOL (Table 6).

7. Discussion

Type 1 diabetes (T1D) is a serious, life-threatening disease affecting a steadily growing number of children and adolescents. Treatment requires adherence to a strict daily regimen that involves frequent monitoring of blood glucose, food intake and insulin dosing. The
responsible for management of diabetes is mainly placed in the hands of patients and their families. 27 One of the major factors that drives the management of child with diabetes is the economic impact the disease produces on the family. The cost incurred in the management of child with diabetes determines, glycemic control, quality of living, mental and social well being of the affected child and his family. Thus there is a complex interaction between, control of blood sugar levels, psychosocial illnesses, quality of life and cost incurred in the management among the adolescents with diabetes.

8. Glycemic control among adolescents with diabetes

In the present study it was observed that, among 50 adolescents with type – 1 Diabetes, 38 (76.0%) were having poor glycemic control. This observation is in line with the results of the study conducted by Abolfotouh MA et al. where about three-quarters (74.8%) of adolescents had uncontrolled glucose levels according to the HbA1c level, and only 25.2% were controlled.12 In another study by van Esdonk MJ et al. among 288 subjects with type – 1 Diabetes, 41.3% were having satisfactory glycemic control.13 Achieving the adequate glycemic control among adolescents with type 1 diabetes is a challenging task, due to fluctuation of hormonal levels related to puberty, difficulty in achieving adherence to drug therapy, psychological stress related to the disease, problems in following diet and physical exercise etc. Mean HbA1C which depicts blood sugar control over previous three months, was 9.55 ± 2.40 in the present study compared to the studies conducted by Hood K K et al.11 and Silverstein J et al.14 where HbA1C levels were 8.7 ± 1.4% and 8.3 ± 1.7% respectively. On the other hand our findings are similar to that of the results of the study conducted by Abolfotouh MA et al.,12 where the levels were found to be 9.16%. The reason for this high HbA1C levels in the present study may be due to the fact that our centre being a tertiary care centre with the Endocrinologist, many cases would have been referred from the other centers due to difficulty in achieving glycemic control.

9. Cost incurred in the management of diabetes

In the present study, the median annual total cost on management of diabetes among study subjects was Rs. 25758/- of which major contribution was from direct costs (90.9%). The cost calculated in the present study is almost double as that reported by Shobhana R et al.15 in their study conducted in Southern India in the year 2002, where the total cost incurred was found to be Rs. 13980/-. Das A et al.4 in their systematic review on cost incurred in management of type 1 report the sum of Rs. 16800/- per annum of which 90% through direct expenditure through medicine, consultation and hospitalization. In the present study, the indirect cost was substantially low as most of the patients were coming to hospital from the nearby places, accompanied by mothers of whom majority were housewives. The place where the study was conducted is a second tier city where the expenditure for private transport and food are relatively less.

10. Relationship between cost of care, glycemic control, psycho social illness and quality of life among subjects with diabetes

In the present study, we tried to explore the complex interaction between glycemic control, cost of care for diabetes, psychosocial illnesses, quality of life among the subjects with type – 1 diabetes. We observed that, there was a negative correlation between cost of care and HbA1C levels. It indicates that, the subjects who spend more on their diabetic management will achieve better glycemic control and vice versa. The point to concentrate here is that, the major proportion of expenditure in the present study was direct cost related to drug (insulin), consultation, investigations and hospitalization. These are most essential components of diabetes care, thus a type-1 diabetic subject, who fails to consult doctor on regular basis, irregular in insulin intake, don not keep check on his glycemic parameters through investigations is more prone to have unsatisfactory glycemic control. Similar observations were made by van Esdonk et al.13 where they have observed that there was negative impact of cost of care on glycemic control among children with type 1 diabetes.

In the present study 32% of subjects were having one or the other psychosocial illnesses. The glycemic control parameters were slightly on higher side among subjects with psychosocial illness, but the differences were not statistically significant. These findings were similar to the observations by Silverstein J et al.14 and Sendela J et al.,16 where there was marginally higher level of HbA1C among subjects with psychological problems like depression. The spending on diabetes care was lower among the subjects with psychosocial illnesses compared to their counterparts. This correlates well with poor glycemic control parameters. Thus we can hypothesize that, the poor spending on diabetes care leading to poor glycemic control and psychosocial illness or the contrary.

The quality of life was found to be poor among 62% of subjects with type 1 diabetes in the present study. Subjects with good quality of life scores also had better spending on diabetes care and did not have psychosocial illnesses.

Thus from the observations of the present study, we can state that, there is a strong relationship between, cost of care, glycemic control, psychosocial illnesses and quality of life among adolescents with diabetes. There is a need to conduct further studies involving larger sample size to establish these relationships further.

11. Conclusion

There was a negative correlation between cost of care and HbA1C levels. The spending on diabetes care was lower among the subjects with psychosocial illnesses compared to their counterparts. The glycemic control was found to be poor among subjects with psychosocial illness compared to their normal counterparts. The quality of life was found to be poor among subjects with poor glycemic control and those who spend less on diabetes control.

12. Limitations

The present study is a hospital based one and the subjects selected are the one’s who visit the hospital regularly. This may lead to Berksonian Bias. As the design chosen for the study is cross sectional, we could collect the data on cost based on three previous visits and extrapolated to the whole year. The longitudinal study through follow up and strict documentation serves as a better method for cost analysis. Recall of indirect costs like conveyance charges, daily wages of the care givers were subject to bias. Keeping in mind the small sample size to establish these relationships further.

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References