Original Research Article

A prospective cross sectional study of diabetes mellitus in children and early detection through community screening program in defined group of children

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Abstract

Background: Prevalence of Diabetes Mellitus among children is very low. Besides, in a developing country like India, the predominant cause of mortality and morbidity in infancy and childhood continue to be infectious, malnutrition and parasitic disorders. As a result, non-communicable diseases such as DM had not received sufficient attention from the health planners and professionals **Aims:** To study the incidence, clinical features, occurrence of various complications of Diabetes mellitus in children and to study the feasibility of detecting Diabetes Mellitus through a community based screening programme in a defined group of children. **Materials and Methods:** The study included all patients admitted in pediatric medical wards of BGH from March 2017 to February 2018. All patients suspected or known to have DM were studied through their stay in the hospital and followed up at-least upto three months after discharge. A detailed history and anthropometric measurements were taken from all the patients according to the proforma at the time of admission. The main stress was given on presenting symptoms. Clinical examination included vital data, general and systemic examination. Investigations included the urine sugars, blood glucose levels, serum acetone, glycosylated hemoglobin. To study the feasibility of screening for DM in the community, this project was taken up in a sample size of 1000 school children.1000 school children aged 5 years were screened in one of the lower socio-economic class area for DM (amraiwadi municipal school 1,2,3 and 4). The main screening test used was urine glucose estimation in all and blood glucose estimation in symptomatic children. **Results:** Of the total number of patients admitted, 18 were diagnosed as DM. 75% of the cases presented with Diabetes Ketoacidosis and its symptoms Breathlessness (50%), Altered sensorium (35%), Vomiting (40%) and Abdominal pain (35%). The complications seen were Hyperglycemic coma [2], Hypoglycemia[2], Hypertension (1) and Infections (2). The Community based screening for DM in a defined group of children has shown that of the 1000 children screened none of the urinary or blood samples showed positive results. **Conclusion:** Diabetes Mellitus (DM) though rare, must be one of the differential diagnosis among patients of all age groups with clinical presentation of breathlessness, altered sensorium/coma, vomiting or abdominal pain as classical symptoms of DM may not be commonly seen. Large scale screening studies must be undertaken for early detection of DM and thus to institute early therapy. Early therapy may itself prolong the remission phase or mitigate the disease process.

Key Word: Diabetes Mellitus, Ketoacidosis, Hypoglycemia.

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INTRODUCTION

Diabetes Mellitus (DM) is a condition commonly associated with obese adults. Its prevalence among children is very low. Besides, in a developing country like India, the predominant cause of mortality and morbidity in infancy and childhood continue to be infectious, malnutrition and parasitic disorders. As a result, non-communicable diseases such as DM had not received sufficient attention from the health planners and professionals until the Vllth 5-year Development Plan (1985-89), when the Government of India allocated funds for the management and control of non-communicable diseases such as DM. For the affected child or adolescent, DM is a major disease, a lifelong disease with many possible complications and with a profound impact on the patient and his entire family.The clinical presentation of DM may mimic many common conditions and diagnosis may be delayed or even missed due to lack of awareness among the patients and its non-recognition by the doctors in practice. In a diagnosed patient, proper management may be hampered by lack of education, motivation and medical facilities. With advances in etiopathogenetic aspect of the disease and management modalities, it is possible for a diabetic child to have a normal life span and a near normal metabolic control. At our Institute, which is an apex referral hospital and an academic institute, we have facilities for diagnosis and management of diabetic children. More than a decade has passed since the last clinical study on diabetes mellitus in children was done in our institute, which prompted me to undertake this study for my dissertation.

MATERIAL AND METHODS

The study included all patients admitted in pediatric medical wards of BGH from March 2017 to February 2018. All patients suspected or known to have DM were studied through their stay in the hospital and followed up at-least upto three months after discharge. A detailed history and anthropometric measurements were taken from all the patients according to the proforma at the time of admission. The main stress was given on presenting symptoms. Symptoms related to Diabetic Ketoacidosis (DKA) such as sudden or unexplained onset of breathlessness, altered sensorium, vomiting, vomiting and those related to DM – recent loss of weight, polyuria, polydipsia, polyphagia and recurrent or prolonged duration of infection was enquired. Family history of DM was also obtained[1,2,4,7,10] Clinical examination included vital data, general and systemic examination. Investigations included the urine sugars, blood glucose levels, serum acetone, glycosylated hemoglobin. At the time of discharge, patients were advised for the diet, exercise, management at home and follow-up. A diabetic card carrying detail of the patient regarding the name, age, address, diagnosis, treatment and instructions was issued. The patients were advised to monitor urine sugars at home and get glycosylated hemoglobin done every three months.

Criteria for the diabetic control:

1. Good control: FBS < 110 mg/dl, HbA1c = 6 -8
2. Fair control: FBS 110 – 140 mg/dl, HbA1c = 9 - 11
3. Poor control: FBS > 140mg/dl, HbA1c ≥ 12

Community based screening for DM in a defined group of children

To study the feasibility of screening for DM in the community, this project was taken up in a sample size of 1000 school children.1000 school children aged 5 years were screened in one of the lower socio-economic class area for DM (amraiwadi municipal school 1,2,3 and 4).[12]

The screening test used was urine glucose estimation in all the children.

In addition, blood glucose estimation was done in children who had symptoms of:

- Polyuria, polydipsia, polyphagia
- Nocturnal eneuresis after achieving bladder control
- Failure to gain weight or loss of weight
- Obese children
- Children with of positive family history DM
- Children whose urinary glucose samples were suspicious.

RESULTS

During the two years study period, there were a total of 8487 admissions in the pediatric medical wards of our hospital.

Incidence: Of the total number of patients admitted, 18 were diagnosed as DM.

Table 1: Age of onset and sex distribution

Age of onset	Male	Female	Total	Percentage
< 5 years	1	2	3	16.67
5– 10 years	4	3	7	38.89
> 10 years	4	4	8	44.44
Total	**9**	**9**	**18**	**100**

Table 2: mode of presentation of DM at time of Hospitalization

	Male	Female	Total	Percentage
Dka	9	6	15	75
Non dka	2	3	5	25

Table 3: Presenting symptoms and signs

Presenting symptoms	No of cases	Present study (%)	Giribala study (%)
Related to DKA			
Breathlessness	10	50	80
Altered sensorium	07	35	70
Vomiting	08	40	10
Abdominal pain	07	35	70
Non related to DK			
Polyuria, Polydipsia, Polyphagia	07	35	40
Failure to gain/lose weight	04	20	50
Fever	10	50	45
Presenting symptoms:			
Acidotic breathing	11	55	80
Dehydration	11	55	80
Altered sensorium			
Lethargy, Drowsyness	3	15	70
Stuper	1	5	
Coma	3	15	
Associated features:			
Signs of infection	07	35	25
Protein energy malnutrition/undernutrition	13	72.2	80

Table 4: Incidence of complications

Complications	No of cases
Hyperglycemic coma	2
Hypoglycemia	2
Hypertension	1
Infections	2

Table 5: Community based screening for DM in a defined group of children

	Males	Females	Total
5 – 10 years	395	200	595
11 – 14 years	250	155	405
Total	**645**	**355**	**1000**

DISCUSSION

Incidence In the present study prevalence of DM is 2.4 per cent 1000 sick children. Incidence of type 1 DM ranges from 34.9 per 1 lakh population (Finland highest incidence) to 0.7(Pakistan)[4,5,6,7] In India it is 0.4/1000 children on an average with a higher number in urban areas. A study in south India showed a prevalence of 0.1/1000 children.[10] Prevalence rates as high as 0.6 per 1000 population have been reported from Gujarat.[2] Giribala's study in own hospital in the year 1987 showed a prevalence of 2.3 per 1000 sick children. In this study equal number of patients were seen in the age categories 5-10 years and >10yrs. Giribala found 50% of the cases in the age group of 5-10yrs Koreans experience suggests a double lump with a peak at 4 years and 11-12 years.[1,3,4,7,14] The youngest patient in the study was diagnosed at the age of 1 ½ years. Though DM was not initially suspected in this patient, repeated blood sugar estimations, urine sugar and serum acetone values confirmed diagnosis. The pt. initially presented acutely with fever, vomiting, breathlessness and cough and was initially treated for respiratory tract infection. Literature mentions patients as young as 1 yr who have been diagnosed as having DM[13,15] Sex incidence: Present study

shows no sex preponderance. Giribala found male preponderance. Slight female majority was found in orient, western literature does not show any significant sex preponderance.[3,14] Presenting symptoms: 75% of the cases presented with DKA in this study against 80% in Giribala's and 40% in AIIMS study[8] Higher percentage of acute presentation can be explained on the fact that initial symptoms and signs might easily be missed by relatives and medical personnel. Besides any kind of stress e.g. infection can precipitate acute decompensation. Breathlessness can be treated as of respiratory or cardiac origin, vomiting can be attributed to acute gastroenteritis, upper respiratory tract infection or even meningitis. There are innumerable causes of coma. Abdominal pain may be treated as surgical case. Hence DM must be considered in the differential diagnosis of cases presenting with these symptoms. Present study shows that the most common features were those of DKA breathlessness(50%) acidotic breathing and dehydration(55%) followed by vomiting(40%),altered sensorium and abdominal pain(35%). Classic symptoms of polyuria, polydipsia and polyphagia very common in adult diabetics were recognized by informants in only 5 cases and in 2 cases affirmative answer was obtained on direct probing. In 4 cases there was complaint of failure to gain weight whereas none of the patients had complaints of actual loss of weight. Fever was present in 50% of the cases and signs of infection were seen in 35% of the cases. Infection was a precipitating cause in 50% of the cases. This compares with the observations 45%, 21%, 65% in other studies. Missed insulin was the cause of DKA in 15% of the cases. Malnutrition was found in 72.2% of the cases as compared to 80% in Giribala's study.[(3)] None of the cases were, however, malnutrition related diabetes mellitus(MRDM) as all the patients had ketoacidosis or ketoacidosis proneness.[(10)] Two of the patients of type 1 DM were subsequently readmitted for hyperglycemic coma. Missed insulin was the reason in one case and non-compliance of diet and insulin was the cause in the other. One patient had hypoglycemia due to omission of feeds and the other developed hypoglycemia due to inadvertant overdose of insulin. Both cases were managed by intravenous glucose administration. One of the patient who was on regular insulin and appropriate diet developed hypertension on follow-up for which antihypertensive drugs were started.[11] One patient had enteric fever on admission along with DKA. Though the blood sugar and acetone values responded to treatment, patients succumbed to enteric encephalopathy. Another patient of 1DDm presented with DKA and disseminated koch's infection and ultimately expired. The patient was not a known case of koch's infection and he was not on regular insulin or diet, probably due to which the infection could rapidly spread to all parts of the body.DKA developed in one known case of portal hypertension which greatly complicated his management.

Mortality

3 of the 18 patients expired due to DKA, hepatic encephalopathy and disseminated koch's in one of case each. Mortality was 16.67%. Mortality rates higher than average population have been recorded among diabetes. Diabetes related complications accounted for 33% of deaths.[(10,16,18)]

Community based screening for DM in a defined group of children

Of the 1000 children thus screened, none of the urinary or blood samples showed positive results.

- Five of the children had complaints of polyuria which was associated with dysuria. Their urine and blood samples were negative for DM. after correction of infection, polyuria disappeared. None of the children has family history of DM
- Seventeen children complained of not gaining weight. However, they had history of worms in stools[15], measles[4], improper dietary habits[12] and evidences of malnutrition[17]. None of them tested positive for urine or blood glucose.

SUMMARY

The present study included 18 cases of DM in children including two readmissions

Maximum number of patients was diagnosed after 10 years of age. However almost equal number belonged to age group 5-10 years. Incidences in both sexes were equal. Most patients belonged to low socioeconomic class. 5 of the patients belonged to middle income group. Positive family history was found in two cases for type II DM. 75% of children had acute presentation of the disease, infection was the precipitating factor in 50% of the patients. Commonest presenting symptom was breathlessness(50%) followed by vomiting(40%). 50% of patients had fever. Commonest signs were acidotic breathing and dehydration. 72.2% of the patients had associated under-nutrition /underweight for age. Initial blood sugar values ranged from 278 to 780 mg/dl, whereas S. acetone was between 20 to 200. All the cases of DKA were successfully treated with priming bolus dose of 0.1U/kg followed by continuous infusion of plain insulin 0.1U/kg/hr. only one patient of DKA expired within 24 hours of hospitalization. Majority of patients with DKA gained consciousness within 24 hours. Total insulin required for correction of DKA ranged from 20 to 150 U. All patients were discharged on twice daily insulin regimes. Only 9 to 18 cases were followed up. Of these 3 showed good glycemic control based on glycosylated

hemoglobin levels. Thus majority of the patients showed poor control. The commonest complication was DKA followed by hypoglycemia. Mortality in the present study was 16.67% amongst diabetic children. No patient of DM was identified through screening programme in a defined population of school children.

CONCLUSION

- DM though rare must be one of the differential diagnosis of clinical presentation of breathlessness, altered sensorium/coma, vomiting or abdominal pain
- Classical symptoms of polyuria, polydipsia and polyphagia may not be commonly seen
- No age is exempt for DM- very young children may also present with onset of DM
- Good metabolic control may prevent or delay the development of some of the complications, if not all.
- However very tight control is not recommended especially in young children
- Large scale screening studies must be undertaken for early detection of DM and thus to institute early therapy. Early therapy may itself prolong the remission phase or mitigate the disease process.

LIMITATIONS OF THIS STUDY

- The results of this study can be explained on the fact that DM has a very low prevalence in children. A sample size of 1000 is very small to yield positive results. Urinary sugar or blood sugar estimation is not very sensitive to identify the very early case of DM. More sensitive and specific tests for early identification of type 1 DM are demonstration of reduced phase 1 insulin response or estimation or detection of autoantibodies to islet cells or insulin in the serum. However it is not feasible to apply these sophisticated tests for screening in the community.

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