ARTICLE

Glycemic Control for Type 1 Diabetic Children in Tripoli Children Hospital, Tripoli, Libya

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Abstract

Background: Management of type 1 DM (T1DM) has changed dramatically over the past 30 years. Newer insulin regimens improved the ability to maintain near-normal glycaemia safely. We aimed to audit our experience with two different strategies of insulin therapy namely premixed insulin (BD) and multiple daily injections (MDI) by assessment of well being, glycemic control and risk of acute complications. **Patients and Methods:** Patients T1DM for at least 1year who are attending at the endocrine clinic in Tripoli Children's Hospital between 2006 and 2007 were studied. Patients who were on BD insulin and got changed to MDI insulin were reviewed (20 patients) and those who on BD insulin and poor diabetic control (HbA1C > 9) were switched to MDI and were followed up for 1 year. The age of patients at the time of diagnosis of DM ranged from 2-16 years (mean 8.2±3.2 years). **Results:** 88% of patients were on twice daily therapy for about 1-6 years before they were switched to MDI; when we reviewed patient's age at starting MDI, our patients can be divided in 2 groups, 1st group includes patients aged from 2-7yrs (younger age group) and they were on twice daily therapy and second group patients aged from 8-16 years with mean age 13yrs±2.4years on MDI. After one year of follow up, 70% had normal weight, 24% were underweight and 6% were overweight. 2% of patients on BD insulin had HbA1c <7% improved to 26% after one year on MDI. 30% of those on BD insulin had acceptable HbA1c 7-9% which improved to 56%after one year on MDI. 68% of those on BD insulin with poor glycemic control (HbA1c>9%) improved to 18% on MDI for one year (P<0.001 for all groups). Hypoglycemia occurred in 26% of patients on BD insulin therapy reduced to only 2% after they were switched to MDI. Diabetic ketoacidosis (DKA), occurred in 14% of patients on BD insulin therapy reduced to none in children on MDI therapy. **Conclusion:** Most of our patients who has received MDI have better growth, glycemic control and experienced less hypoglycemia and DKA. We recommend generalization of intensive insulin therapy as the standard of care to all our patients.

Key words: Type 1 diabetes, Glycemic control, Insulin therapy, Acute complications, Childhood diabete

Introduction

Diabetes mellitus (DM) is a complex disorder with profound consequences and is the most common chronic endocrine disorder of childhood, characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Management of type 1 DM (T1DM) has changed over the past 30 years in particular; new insulin strategies have improved the ability to maintain near- normal glycaemia (1-3).

Treatment strategies have evolved to achieve physiological insulin replacement with subcutaneous injections of insulin but became more difficult. The more sophisticated the treatment regimen, the more closely can physiological insulin release be mimicked with new treatment options like continuous subcutaneous insulin infusion (CSII) commonly known as the insulin pump therapy and multiple daily injections (MDI) for of insulin therapy. Alternatively, this goal may possibly be reached in a more convenient

manner by using the twice daily split and mixed insulin regimen involving the use of rapid or short acting insulin combined with intermediate acting insulin administered before breakfast and before the evening meal.

Beyond remission period, it is not generally possible to achieve near- normal glycaemia with two injections per day. Whereas the more physiological "Basal-bolus regimens" delivers insulin therapy with at least 3-4 injections each day can move closely simulate normal insulin profiles and permit greater flexibility with respect to timing and content of meals. Continuous subcutaneous insulin infusion (pump therapy (2-3). The optimal glycemic control in T1DM requires intensive insulin therapy such as that used in the diabetes control and complications trial (DCCT) which showed a 34-70% reduction in diabetic microvascular complications in patients who received intensive diabetes therapy compared to patients assigned to standard diabetes management (4). There are limited data on intensification of insulin therapy in our country (5). The present study aimed to compare two different strategies of insulin therapy (viz. twice daily insulin and multiple daily injections) by assessment of patient's growth, level of HbA1c and occurrence of acute complications [diabetic ketoacidosis (DKA) and significant hypoglycemia) in the two groups.

Patients and Methods

Fifty patients were included (Figure 1); age at the time of diagnosis ranged between 2 and 16 years with (mean 8.2±3.2 years). Majority of patients' age ranged between 5 and 13 years. This was a prospective study includes the patients who were diagnosed as T1DM for at least 1yr at endocrine clinic in Tripoli children's hospital (2006- 2007). Patients who were on twice daily insulin injections & who changed to MDI before our study were reviewed (20 patients) and those who on twice daily injections with poor diabetic control (HbA1c > 9). All were switched to MDI, 3 doses of pre-meal insulin (regular insulin) and 2 doses of basal insulin as NPH or 1 dose as Glargine (30 patients). All were followed up for 1 year. Insulin doses ranged between 0.7-1.5 u/kg/d according to the requirement of individual patients. Dietary advice was given at most of clinic visits as part of their clinical care. Data captured for analysis included body weight, height, body mass index, HbA1c and frequency of hypoglycemia (either symptomatic or if BS <70 mg/dl) or DKA.

Statistical analysis was performed using SPSS (taking p value<0.05 as the accepted level of significance). We considered that HbA1c < 7% tight control, 7-9 accepted > 9 poor control.

Results

Duration of diabetes:

As shown in figure 2 , nearly half of our patients (48%) had DM for 1-4years duration and a similar proportion (48%) for 5-8years, and only a small group (4%) had DM for longer periods (9-12yrs).

Duration and types of therapy:

Figure (3) shows the distribution of patients according to duration of twice daily therapy, we found 46% of our patients. Were on conventional therapy for 1-3 years, another 42% for 4-6yrs and 2% for about 10-12 years. So about 88% of patients were on twice daily therapy for about 1-6 years before we switching them to MDI.

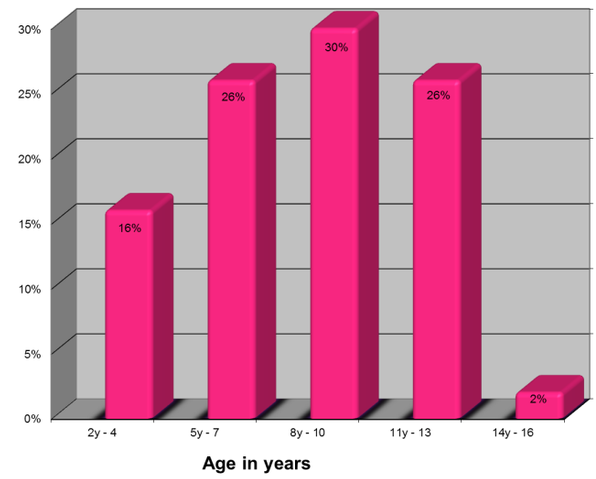

Figure 1. Age distribution of the study population.

Patients can be divided in 2 groups: 1st group includes patients aged from 2-7yrs (younger age group) and they were on twice daily therapy not on MDI and other group on MDI includes patients who were >7years old with mean=13yrs±2.4years (Figure 4a).

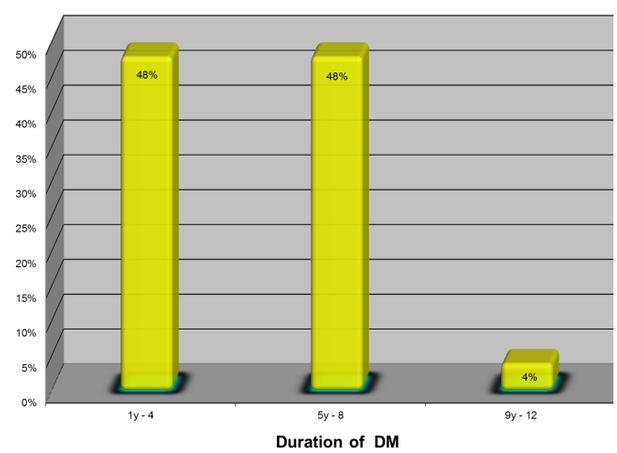

Figure 2. Distribution of patients according to duration of diabetes.

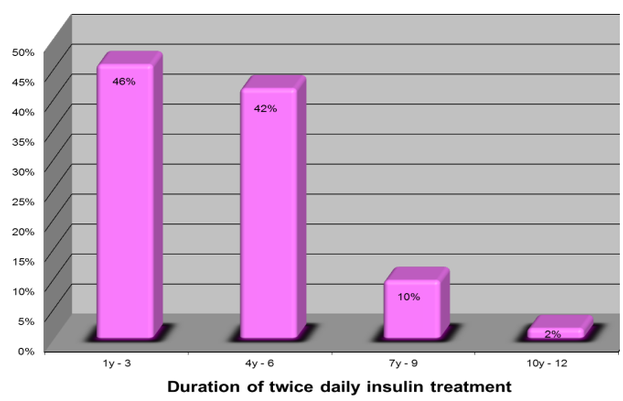

Figure 3. The duration of prior treatment with premixed insulin.

40% of patients were already on MDI for a period ranged from 2-5yrs, another 60% of them switched to MDI, then all followed for 1year (Figure 4b). 70% of our patients (on MDI) under study have normal weight, 24% were underweight and 6% were overweight. Unfortunately we could not get BMI for those patients

were on twice daily therapy because our data lack of height measurement.

Glycemic control:
Only 2% of patients on twice daily have good glycemic control HbA1c<7% which raised to 26% on MDI, 30% of patients have accepted HbA1c 7-9% on conventional therapy which raised to 56% on MDI, 68% of our patients on twice daily therapy have poor glycemic control HbA1c >9%, which reduced markedly to 18% on MDI (the difference between means of HbA1c of patients in each group is statistically significant P value <0.001).

Acute complications:
Hypoglycemia occurred in 26% of patients on twice daily therapy had attacks of hypoglycemia reduced to only 2% on MDI. Figure (9) 14% of patients on twice daily therapy were suffered from DKA, but no any patients on MDI suffered from DKA.

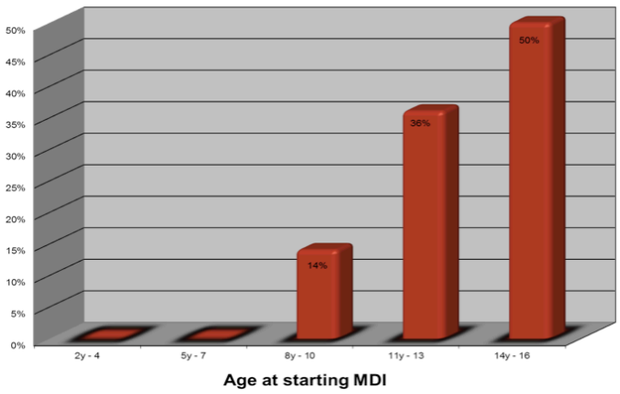

Figure 4a. Age at the start of MDI regimen

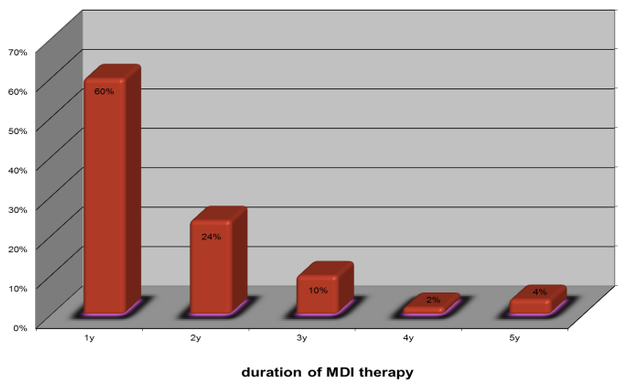

Figure 4. The duration of MDI therapy.

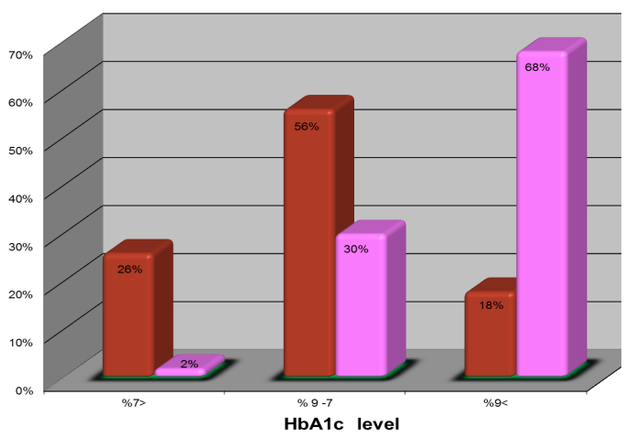

Figure 5. Glycemic control in the MDI and BD regimens.

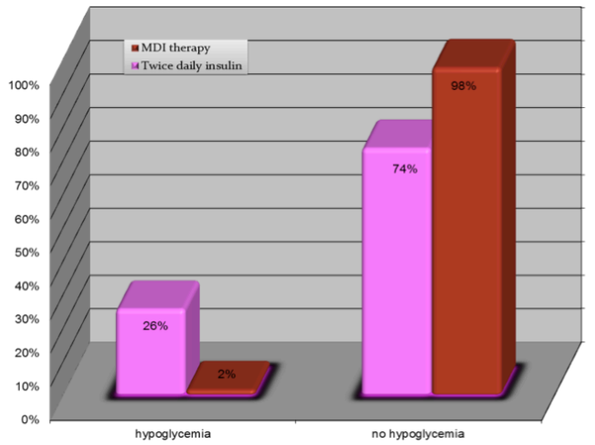

Figure 6. Hypoglycemia rates in the MDI and BD insulin groups.

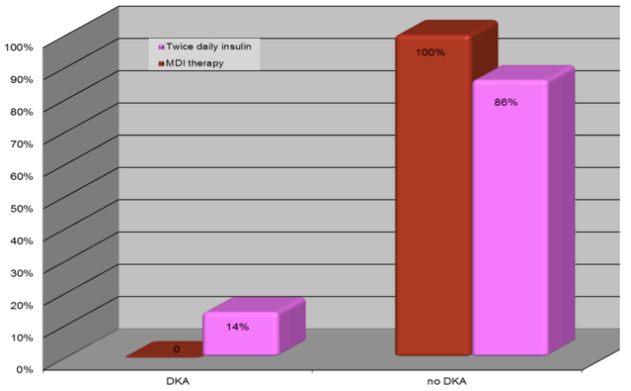

Figure 7. Rates of diabetic ketoacidosis in the MDI and BD insulin subgroups.

Discussion

The incidence of T1DM is rapidly increasing particularly in specific regions of the world. The rate of increase is greatest among the youngest children. In the USA, the overall prevalence of diabetes among school aged children is about 1.9/1000, increasing from a prevalence of 1/1430 at 5 years of age to 1/360 children at 16 years (6) In our study we found the age of patients at the time of diagnosis ranged from 2 to 16 years old with mean 8.2 ± 3.2 years, 16% diagnosed on age 2 to 4 years, 26% diagnosed on age 5 to 7 years and 30% diagnosed at age 8 to 10 years, 26% diagnosed at age 11 to 13 years, this mean that DM increase in frequency with age, also these results achieved by Kadiki et al (5). However only 2% of our patients presented at 14 to 16 years, this can be explained by a tendency of those patients to attend adult diabetic clinic instead of the pediatric clinic. The conventional insulin therapy (twice daily injections regular with NPH or premixed insulin) usually works adequately while endogenous insulin may still be produced. However, as more complete insulin deficiency develops this regimen becomes less effective and intensive therapy mostly in the form of MDI region will certainly be required to maintain normal-near normal glucose control (6).

In the present study, our patients could be divided in two groups. 1st group includes patients aged from 2 to 7 years (younger age group) and they were on BD insulin therapy still none of them need to switching to Multiple Daily Injection and other group (2ed group) includes patients who are > 7 years old with mean = 13 ± 2.4 years, we found the number of patients on MDI

increased with increased age because when the children are getting older the requirements of Insulin will be increased and Twice daily therapy not more enough to control their blood sugar and we need to switching them to MDI for more optimal control. The prognosis with regards to growth in children and adolescents with type 1 DM has improved considerably with better disease management. The introduction of multiple Insulin injection, Glucose monitoring has achieved near-normal Glucose level. The latter is thought to be responsible for good growth perspectives in children with diabetes (7). In our study the results showed 70% of those patients on MDI have normal BMI and 24% have under-weight and another 6% have over wt. Unfortunately we couldn't get BMI for those patients while on conventional insulin therapy because the data for height is not available. A study was done on 2002 in USA on 44 patients (2 – 16 years old) on conventional Insulin regimen, these patients were transitioned from conventional Insulin therapy to multiple daily injection and BMI was obtained before and after initiation of MDI therapy results showed there was improvement of glycemic control without producing an abnormal increase in BMI (7).

Since publication of the DCCT results, HbA1c measurements have been considered as the gold standard for monitoring Glycemic control and served as a surrogate for diabetes related complications. The target HbA1c targets currently recommended for children and adolescents with T1DM are ≤ 8.5% for toddler and preschool age group (≤ 6 years), < 8% for school age (6 to 12 years), 7.5% for adolescents and young adults (13 to 19 years of age). (8)

In our study if we compare between two regimen (Conventional BD therapy and MDI) by HbA1c level we found only 2% of patients on BD therapy have good glycemic control (HbA1c < 7%) compared to 26% on MDI while patients on MDI, 68% of patients on conventional therapy have poor control HbA1c >9% which reduced markedly to 18% while patients on MDI the difference between mean of HbA1c of patients in each group is statistically significant ($p<0.001$). Diabetes control and complications trial (DCCT) has conclusively proven that intensive therapy by MDI improves long term glycemic control (HbA1c) (4), also the results of study which done in USA which mentioned before showed when patients transitioned to MDI, there was improvement in glycemic control (i.e. near target HbA1c). Despite the results of DCCT/EDIC study and some calls to reassess the glycemic control set by ADA particularly for adolescents (9). Unfortunately, even the currently suggested age-specific glycemic goals for children and adolescents with T1DM remain difficult to achieve and having these patients reach the target glycosylated HbA1c value remains a challenge for even the most skilled provider. 82% of our patients on MDI have HbA1c below 9%, hypoglycemic episodes decrease from 26% to only 2% on MDI; No episodes of DKA in this year on MDI if compared by14% while on conventional therapy previously. Many studies confirmed that the introduction of MDI will decrease risk of hypoglycemia compared to conventional therapy. There is study carried in Spain 2007 comparing conventional treatment and intensive treatment (MDI) in T1DM pre pubertal patients, results showed intensive treatment during First year to four years was safer than conventional therapy (twice daily injection) and decreasing risk of severe Hypoglycemia this is because of more flexibility of treatment.

In conclusion, most of our patients who were receiving multiple daily insulin injections have better growth, glycemic control & less occurrence of hypoglycemia and diabetic ketoacidosis. We recommend to use MDI injection for all our T1DM patients to achieve good control soon after diagnosis to proceed to flexible insulin therapy.

References

1. Diabetes in childhood and Adolescence10 Volume K. Dahl- Jorgensen, W. Kiess, 2005.
2. Brook's Clinical Pediatric – Endocrinology edited by Charles Brook, Sixth edition ;2009; pp: 474-5.
3. American family physician published by American Academy of family physicians, November 15, 1999.
4. The Diabetes Control and Complications Trial Research Group The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329:977-986.
5. Kadiki OA, Roaeid RB. Incidence of type 1 diabetes in children (0-14 years) in Benghazi Libya (1991-2000). Diabetes Metab. 2002;28(6):463-7.
6. Kapellen TM, Galler A, Kiess, W. Insulin Treatment. In: F Chiarelli, K. Dahl-Jørgensen, W. Kiess. Diabetes in Childhood and Adolescence 2005;10:122-138.
7. Alemzadeh R, Palma-Sisto P, Parton E., Totka J., Kirby M. Beneficial effects of flexible insulin therapy in children and adolescents with type 1 diabetes mellitus. Acta Diabetologica. 2003;40(3):137-42.
8. Sacks DB, Bruns DE, Gold Stein DE, Maclaren NK, McDonald JM, Paroot M. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. Clinical chemistry 2002;48 (3):436-72.
9. American Diabetes Association. Standards of Medical Care in Diabetes-2013. Diabetes Care. 2013 Jan; 36 (Suppl 1): S11-S66.

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