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## Is Insulin Pump a game changer in the management of Diabetes Mellitus: A case series

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### ABSTRACT

*Prevalence of diabetes has drastically increased over the past decade and it has a debilitating effect on one's quality of life. The Insulin Pump is a relatively new modality in the management of Diabetic patients. The objective of our case series was to assess the impact of insulin pump on glycemic control and quality of life of diabetic patients. In this case series we have presented four Type 2 diabetic cases which presented with different common complications associated with diabetes as well as its management, particularly the complication of hypoglycemic episodes. Worldwide introduction of insulin pump can prove to be a trend changer in the management of diabetes*

**Key Words:** Diabetes mellitus, Insulin, Quality of life

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### INTRODUCTION

In 2014 the global prevalence of Diabetes Mellitus Type I was estimated to be 9% among adults (1). This not only leads to increased disease burden on the country but also reflects poorly on the health care system. It has been estimated that \$245 billion were spent on diagnosed diabetics [2] with \$176 billion for direct medical cost [2]. Treatment principally comprises of insulin replacement. This can be provided by either subcutaneous injections or, insulin pumps. The objective of our case series was to assess the impact of insulin pump on glycemic control and the quality of life of diabetic patients.

#### Case 1:

Patient is a 35 years old woman who was diagnosed with diabetes 8 years back. Before being put on insulin pump she was using novolog (aspart) and lantus (glargine). She would frequently experience episodes of hypoglycemia and at the same time her sugar charting was often recorded on the higher side. The patient did not complain about any numbness in arm or leg. Her HbA1C level was 11.37%. Along with diabetes she also had hypothyroidism related to thyroidectomy that was performed in 2008. The patient was placed on Insulin Pump Novolog (aspart). The insulin pump's basal rate was set to 1.1. Insulin: Carb ratio was 1:5 and insulin sensitivity was 1:15

On 6th October 2014 the patient presented to the OPD with the complaints of intermittent numbness and tingling sensation in her feet. She reported to have been non-compliant with her diet and indulging in binge eating. She was advised to start exercising and to opt for a balanced diet. She was also referred to an ophthalmologist and podiatrist. She was started on two different basal rates. From midnight to 1pm the basal rate was 1.1 and from 1 pm to Midnight basal rate was 2.2. Rest of the settings remained the same.

On 13th November 2014 the patient presented to the OPD for follow up. She was 5 weeks pregnant at that time. She was using only Humalog via Insulin Pump for diabetes and levothyroxine (137 mcg once a day) for hypothyroidism. Patient had decreased her appetite significantly and was trying her best to have a balanced diet. Her blood sugars were still high and fluctuating. She did not complain about any numbness, urinary or visual complaints. The basal

rates were changed once again. From Midnight to 6am- 1.3, from 6am to 12am-1.3 and from 12 to midnight-2.4. Insulin: Carbohydrate ratio was changed to 1:3 but the sensitivity was kept the same.

On 13th June 2015 the patient presented to the OPD for follow up. Her HbA1C was 6.8% this time and her fasting blood glucose level was 124 mg/dl. The Basal rate from Midnight to Noon was changed to 1.7, basal rate from noon to 6pm was changed to 2.6 and basal rate from 6pm to midnight was increased to 2.8.

The patient was again seen on 22nd July 2015 with an improved HbA1C of 6.6%. She did not have any complaints and was feeling more energetic than ever before. Patient was particularly happy that she stopped having hypoglycemic episodes since the past two years and because of the insulin pump she had more flexibility on her meal timings.

#### **Case 2:**

Patient is a 48 years old woman who is a known case of diabetes since 2005. She presented to the clinic for the first time on 4th November 2014. Her blood glucose levels were reported to fluctuate, mostly in the range of 140-264mg/dl. Her C-Peptide was 0.6 and her HbA1C was 8.0%. As a complication of her Diabetes she had developed cataracts in both her eyes and was to undergo surgery in 3 weeks' time. Apart from that she had diabetic nephropathy and numbness in both her feet. The patient also had pain in both of her legs. The pain was intermittent and burning in nature. There were no relieving or aggravating factors for the pain. She was started on Novolog (aspart),(30, 30 and 35 units) and Lantus(glargine) 15 units in the morning. For her neuropathy she was started on Lyrica (pregabalin) 50mg BID. Later on, the doses were increased but her blood glucose levels remained on the higher side. Her HbA1C was 7.0 and her blood glucose levels were in the range 100-300. Patient was trying her best in terms of diet and exercise.

On 18th December 2014 she was started on Insulin Pump with Novolog (aspart). The basal rate was set to 2.6 units/hour, insulin to carbohydrate ratio was 1:4 and insulin sensitivity was 1:16.

On her later visit there was slight improvement in her blood glucose levels however the levels still remained on the higher side, especially the fasting glucose level hence her insulin pump settings were changed. Her basal rate was changed to 2.8 units from midnight to 5am. The basal rate for the rest of the day was still 2.6 units. Insulin to Carbohydrate ratio was changed to 1:3 and Insulin Sensitivity was not changed.

Patient presented to the OPD again on 16th March 2015. Her blood glucose levels were in the range of 89-240 and HbA1C level was 6.7%. Patient was still using Lyrica for leg pain. She felt more healthy and energetic. Her basal rates were again modified in order to get a better control. Basal rate from midnight to 5am was 2.8, 5am to 12pm was 2.6, noon to 7pm was 3.0 and 7pm to midnight was 2.6. The insulin sensitivity was changed to 1: 15. Insulin to Carbohydrate ratio was kept the same. Over a period of 5 months her blood glucose level before breakfast, lunch and dinner were 99,115 and 110 respectively while her HbA1C improved to 6.2%. The patient had no numbness or pain in her feet. According to the patient the insulin pump has improved both the diabetic control and quality of life. She finds the pump more convenient and easy to use.

#### **Case 3:**

Patient is a 68 years old lady who was diagnosed in 2004. Before being put on insulin pump she was using Lantus (glargine), Symlin (pramlintide) and Apidra (glulisine) for diabetes. She presented to the OPD on 24th August 2014 and reported her blood glucose levels, which before breakfast were in the range of 90-115; before lunch were in the range of 120-180; before dinner were in the range of 130-240 and blood glucose levels before bed time were in the range of 80-270, in short she had fluctuating readings. Subsequently her HbA1C level was 9.1. She reported to have been trying her best in terms of diet and exercise.

The patient was placed on Insulin pump (Novolog) on 8th November 2014. The insulin pump's basal rate was set to 0.7units per hour. Insulin to carbohydrate ratio was set to 1:12 and sensitivity was set to 1:60. Shortly afterwards her blood glucose levels began to improve. Her mean blood glucose level was down to 162 mg/dl. There were no new complaints.

The patient was later seen on 29th November 2014. There were no new complains. Her mean blood glucose level was 157 mg/dl. Her insulin to carbohydrate ratio was changed to 1:10. Rest was continued as it was. She was advised to keep a strict control on her diet.

On 30th May 2015 she presented to the OPD for follow up. Her mean blood glucose level was 135mg/dl and HBA1C improved to 7.5%. Her basal rate was set to 0.9units per hour from 4pm to 8pm. For the rest of the day her basal rate was set to 0.7 and insulin to carbohydrate ratio changed to 1:8. No other changes were made. Patient did not experience any hypoglycemic episodes. According to her she felt progressively more energetic and healthier.

#### **Case 4:**

Patient is a 65 years old lady who is a known case of Type 2 Diabetes. She presented to the clinic for the first time on 17 February 2015 with the complaint of recurrent hypoglycemic episodes. She was taking Edarbi (azilsartan),Cardizem (diltiazem), Vit D and Humalog (lispro). Her HBA1C was 7.5% .

She was started on insulin pump and insulin Humalog was adjusted to 100 units /day with insulin:carb ratio of 1:4 and sensitivity of 1:40.On her next visit patientreported that she had started Cinnamon and Chromium picolinate. She did not have any active complaints and was following a strict diet. She was walking 4.5 miles/ 4 times a week.

Patient again presented on 19th May 2015. Since her last visit, there had been no episode of hypoglycemia. Her random blood glucose level was found to be 146mg/dl. At this point her Insulin pump sensitivity was changed to 1:30, with the insulin carb ratio of 1:4. By August23<sup>rd</sup>, patient's HbA1C had improved to 6.2% while her fasting blood glucose level was 120mg/dl. Patient felt more energetic and healthier than before. Patient was satisfied with her current therapy.

### **DISCUSSION**

Insulin pumps have recently gained popularity in US. More than 400 000 patients are estimated to have used it in US alone [3]. It also has shown to be more effective than multiple daily injections in optimizing glycemic control [4-6]. If proper education is given, insulin pumps can improve hypoglycemia awareness [7-8]. This greatly reduces the chance of hypoglycemic episodes [7]. Insulin pumps helps in preventing dawn phenomenon and thus prevents low blood glucose level at night time [9].

Studies show that use of insulin pump yields better quality of life especially "insulin management" and "injections," as well as "diabetes management," "behavior," "school," "family life," "daily life," and "physical activities"[10]. Our study had similar results. It has "allowed optimization of metabolic control, reduction of the daily insulin requirements and achievement of a higher level of satisfaction with no change in lipid profile, no weight gain and without increasing the frequency of adverse events" [11]. Insulin pump also helps in alleviating neuropathic pain [12].This effect was seen in Case 2 of our study.

### **CONCLUSION**

Insulin Pump improves the glycemic control and quality of life of diabetic patients. It also decreases the frequency of hypoglycemic episodes and provides its user with relative freedom from structured meals. Worldwide introduction of insulin pump can prove to be a trend changer in the management of diabetes.

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