

EXPERIENCE WITH INSULIN PUMP TREATMENT IN INDIAN DIABETICS. A PRELIMINARY REPORT

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SUMMARY

Six insulin-requiring diabetic subjects (five with resistant diabetes and one with brittle diabetes) were treated with continuous subcutaneous insulin infusion on a short-term basis. The blood sugar control was smoother and the insulin requirement was much lower than with conventional insulin therapy. The pump helped to break the insulin resistance in some cases. It is also helpful in the management of brittle diabetes. It is an excellent tool in the management of problem patients with diabetes especially in the hospital setting.

INTRODUCTION

Conventional therapy with multiple injections of insulin daily often fails to provide smooth control of blood sugar in insulin dependent diabetic subjects. Attempts at achieving continuous normoglycemia have resulted in the development of insulin infusion systems. It is now uniformly accepted that by long-term good control of the diabetic state the vascular complications can be either avoided or postponed¹. Continuous subcutaneous insulin infusion (C.S.I.I.) has been tried by several workers²⁻⁵. It has been found to be effective in bringing about normalisation of not only the blood glucose levels but also of lipid and amino acid metabolism⁶.

We have been using insulin pump therapy at one Centre from 1980 and over 25 patients have been successfully treated with this type of treatment. We present below some of our observations with the use of CSII in six of these patients.

MATERIAL AND METHODS

Six insulin requiring diabetic patients admitted to the Diabetes Research Centre and M. V. Hospital for Diabetes, Madras, were taken up for trial with insulin pump treatment. The criterion for selection of these patients was either (i) inability to achieve good uniform metabolic control despite 2 or 3 daily injections of large doses of insulin (80 units and above) of (ii) brittle diabetes.

All the patients were placed on a diet after admission. Initially, the patients were administered 2 or 3 daily injections of insulin. In the patients whose blood sugar values remained high, the dosage was

slowly stepped up. The trial with conventional insulin therapy was continued for a period of at least 3 days before CSII was started. Serial blood sugar estimations were done by the capillary blood sugar method, using the Reflomat (Boehringer Mannheim). Fasting C-Peptide estimations were carried out before commencement of the pump trial to assess the pancreatic beta cell reserve. Insulin antibody indices were also estimated.

The insulin pump we used was the Mill Hill infuser (U.K.). The essential principle of operation of this pump is that the insulin is infused continuously by a battery-driven motor at a rate of 66 ul/hour for a duration of upto 76 hours at which time the insulin has to be reloaded into the syringe. Two or more boosters were given depending on the need, 15-30 minutes before each meal. The boosters were administered by rotating a knob on the side of the pump. Insulin was delivered from the pump through a nylon cannula the tip of which was positioned subcutaneously in the forearm. The infuser was strapped to the arm of the patient. A brief summary of each of the 6 cases taken up for the study is given below.

RESULTS

The clinical features of the patients studied are given in Table 1.

Case-1

Within 24 hours of starting pump treatment with plain Insulin, the post prandial blood sugar values came down to 140 mgs% and throughout the 3 days of pump therapy were maintained within normal limits. The dose of plain Insulin required while using the pump was only 50 units/day. Once the insulin pump was discontinued, the blood sugar shot up and remained high inspite of the administration of large doses of plain insulin.

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TABLE 1: Clinical features of the 6 IDDM patients studied

Case	Age	Sex	Duration of diabetes (Years)	Dosage of insulin before starting therapy	Indication for starting insulin pump
1	15	M	6	plain Insulin 240 U/day	Resistant diabetes.
2	32	F	4	Actrapid M.C. 80 U/day	Resistant diabetes.
3	14	F	2	Combination of Plain + Lente Insulin 45 U/day	Brittle diabetes
4	45	F	12	Actrapid M. C. insulin 90 U/day	Resistant diabetes.
5	58	F	9	Actrapid M. C. insulin 80 U/day	Resistant diabetes.
6	67	M	2	Actrapid M. C. insulin 100 U/day	Resistant diabetes.

Case-2

After she was started on the insulin pump, this patient's post prandial blood sugar fell from 400 mgs%, within 2 days. Even after discontinuation of the pump, the diabetes was kept under fair control with 60 units of insulin per day.

Case-3

Before pump treatment, there were marked fluctuations in her blood glucose levels with frequent episodes of hypoglycemia and ketosis on the same day. During the period of pump treatment with plain insulin, the blood sugar was under good control and was maintained around 200 mgs%, with very minimal fluctuations.

Case-4

Using continuous subcutaneous infusion of Actrapid M.C. Insulin, normoglycemia was established within two days of pump therapy. After discontinuation of the pump, good control of diabetes was maintained with just 40 units of Actrapid insulin in two divided doses daily.

Case-5

Within two days of commencement of continuous subcutaneous infusion of M.C. Insulin, the blood sugar values came down. In fact she developed symptoms of hypoglycemia on the 3rd day. The pump was discontinued and her diabetes was subsequently controlled with 45 units of Actrapid M.C. Insulin in 2 doses.

Case-6

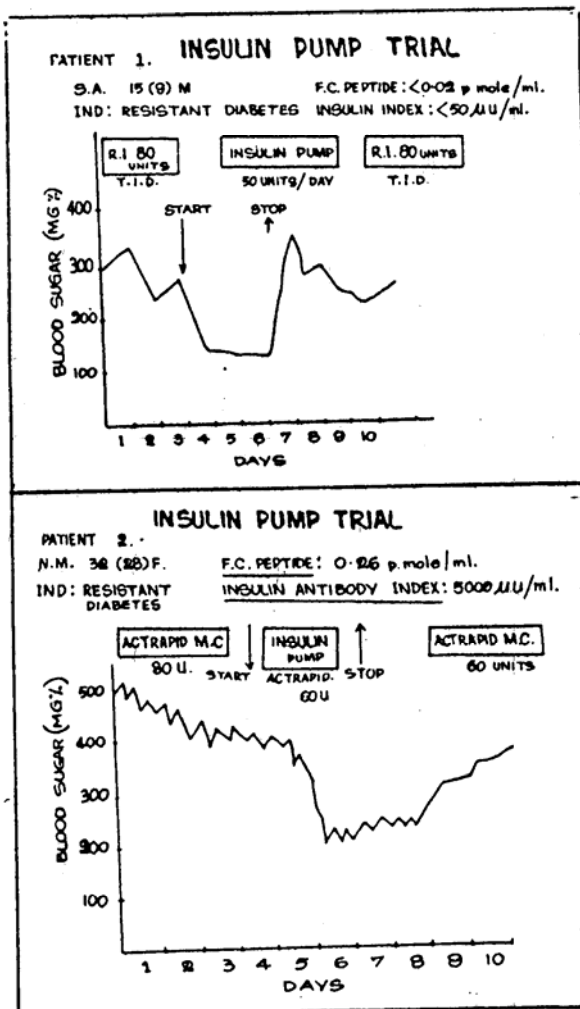
This patient was started on the insulin pump with Actrapid M.C. Insulin and responded to 110 units on the first day. On the subsequent days the dose was reduced progressively to 40 units of M.C. Insulin and the sugar continued to be under good

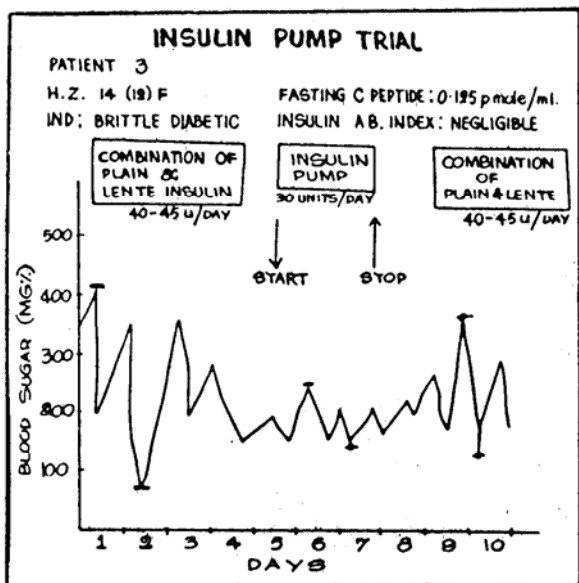
control. After discharge, the diabetes has been controlled with 20 units of monocomponent insulin per day. This was a classical instance of how the insulin pump helped to break the insulin resistance.

To study the reactions of the patients to the insulin pump, a questionnaire was distributed to the patients and the answers were noted. Table 2 shows the answers given by the patients.

TABLE 2

1. What did you feel was the effectiveness of pump treatment?	Excellent (4)	Good (2)
2. How did you feel symptomatically while on pump therapy?	Better (6)	Worse (0)
3. What do you feel about the size of the pump?	Too big (3)	All right (3)
4. What do you think about the cost of the pump?	Too Costly (6)	Fair (0)
5. Do you think you could continue the pump at home on your own?	Yes (3)	No (3)





DISCUSSION

Insulin resistance is often encountered in insulin requiring diabetic subjects. Many such patients have elevated insulin antibody levels. The use of Monocomponent insulin in such cases results in better control of the blood sugar⁷. Patients who do not respond to large doses of M.C. Insulin are rare. Of the six patients in whom we used the insulin pump, 4 patients were on M.C. Insulin and not under control. In these subjects, the use of the insulin pump led to good diabetic control and, in fact, after discontinuation of infusion, the blood sugar was maintained under good control with Actrapid M.C. Insulin. Thus, we found that use of the insulin pump helps to break insulin resistance (as shown in cases 2,4,5 and 6).

Decrease in insulin requirement has been observed following initiation of CSII⁸. In our series, all 6 patients were controlled with a smaller dose of insulin while on the insulin pump. A noteworthy fact was that in 4 of the 6 subjects studied, the diabetes was maintained under good control with the smaller dose of insulin even after switching them back to conventional therapy.

Case-3 demonstrates the usefulness of the insulin pump in stabilisation of brittle diabetes. This is in contrast to reports by Pickup et al that the insulin pump is not useful in the control of brittle diabetes⁹.

All the 6 patients studied felt much better symptomatically while on CSII than during the pre-infusion period. Half of them felt that the pump was too big and uncomfortable. Other workers have also observed the need for a reduction in size and weight of the infusion devices^{8,10}. Three of our 6 patients

were not confident of being able to manipulate the pump at home on their own.

Thus, while insulin infusion therapy is an extremely useful tool in the hospital setting, it is still probably a little early to attempt this on a wide scale in the home setting because of problems related to the cost of the equipment and the need to import accessories. Also home glucose monitoring would necessarily be a pre-requisite to the use of the insulin pump in the home setting.

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