Sustained Efficacy of Insulin Pump Therapy in Type 2 Diabetes: 9-Year Follow-up in a Cohort of 161 Patients

Julia Morera,[1] Michael Joubert,[1] Remy Morello,[2] Anne Rod,[1] Barbara Lireux,[1] and Yves Reznik[1]

Diabetes Care 2016;39:e74–e75 | DOI: 10.2337/dc16-0287

Continuous subcutaneous insulin infusion (CSII) is a valuable option for patients with type 2 diabetes in whom glycemic targets are not met despite multiple daily injections (MDIs) at high insulin doses, as recently demonstrated in the multicenter randomized OpT2mise trial (1). However, data on the durability of glucose control with CSII are lacking (1,2). We report here the long-term efficacy of CSII in a cohort of 161 patients (51% female) with type 2 diabetes who started pump therapy between 1998 and 2012. The patients' mean age was 58.3 ± 9.8 years, and mean BMI was 33.2 ± 6.6 kg/m^2. The mean duration of diabetes was 15 ± 8.1 years, and mean glycated hemoglobin (HbA_{1c}) was 9.0 ± 1.7% (74 ± 18.6 mmol/mol). At baseline, 96% of patients were receiving insulin: 48% were receiving basal-bolus regimens, 37% were receiving premixed MDI, and 11% were receiving only basal insulin. The mean duration of insulin treatment was 6.8 ± 4.6 years, and the mean total daily dose was 1.2 ± 0.9 units/kg. Overall, 66 patients were receiving metformin. The most common reason for pump initiation was HbA_{1c} >8% (64 mmol/mol) (70%), followed by insulin total daily dose >1.5 units/kg (13.9%), burdensome MDI (8.3%), diabetes complications (4.4%), and frequent hypoglycemia (2.5%). Medical data were collected at initiation of pump therapy and annually thereafter. The mean duration of follow-up was 5.1 ± 3.2 years (range 1–14 years). After 1 year of pump therapy, mean HbA_{1c} was 7.7 ± 1.4% (61 ± 15.3 mmol/mol), representing a 1.3% (14.2 mmol/mol) decrease from baseline ($P < 0.001$): overall, HbA_{1c} <8% (<64 mmol/mol) was achieved in 56.2% of patients. Patients receiving basal-bolus regimens at baseline showed a decrease in HbA_{1c} of 0.8 ± 1.3% (8.7 ± 14.2 mmol/mol). Patients whose baseline HbA_{1c} was below 8% (64 mmol/mol) showed no improvement in glucose control on CSII. After 1 year, insulin requirements decreased by 13% ($P < 0.05$), and body weight increased by 2.9 ± 7.6 kg ($P < 0.001$) from baseline. Neither concurrent use of metformin nor the degree of autonomy with the pump significantly affected the response to pump therapy. Over 9 years of follow-up, HbA_{1c} decrease was maintained ($P < 0.05$), daily insulin requirements did not change, and weight gain was stable over 7 years. The percentage of patients lost to follow-up and pump withdrawal was 3.7% and 16.8%, respectively (Table 1).

This retrospective analysis demonstrates the sustained efficacy of insulin pump therapy in patients with type 2 diabetes with MDI failure. Notwithstanding their retrospective and nonrandomized nature, our results are unique and may have important implications for long-term insulin intensification strategies in type 2 diabetes. The strengths of the study include the high number of patients with available long-term data and the clinical and metabolic profile of the cohort, which is very similar to that in the OpT2mise study (1). Further studies are needed to evaluate the impact of pump therapy on cardiovascular and microvascular morbidity and the health economic consequences of this new treatment strategy in type 2 diabetes.

Acknowledgments. The authors thank Michael Shaw (MScript Limited, Hove, U.K.) for editorial support, which was funded by Medtronic.
Duality of Interest. J.M. has attended conferences organized by Medtronic. M.J. has carried out clinical trials as coinvestigator for Medtronic, Eli Lilly, and Novo Nordisk; provided advisory services to Abbott and Medtronic; and attended conferences organized by Eli Lilly, Medtronic, and Abbott as a contributor. Y.R. has carried out clinical trials as coinvestigator for Medtronic, Eli Lilly, and Novo Nordisk; provided advisory services to Medtronic, Abbott, and Eli Lilly; and attended conferences organized by Eli Lilly and Medtronic as a contributor. No other potential conflicts of interest relevant to this article were reported.
Author Contributions. J.M. and Y.R. wrote the manuscript. M.J., A.R., and B.L. researched data, contributed to discussion, and reviewed

[1]*Department of Endocrinology, University of Caen, Côte de Nacre Regional Hospital Center, Caen, France*
[2]*Department of Statistics, University of Caen, Côte de Nacre Regional Hospital Center, Caen, France*
Corresponding author: Yves Reznik, reznik-y@chu-caen.fr.

Received 9 February 2016 and accepted 28 February 2016.

the manuscript. R.M. performed the statistical analyses. Y.R. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Prior Presentation. Parts of this study were presented at the 8th International Conference on Advanced Technologies & Treatments for Diabetes, Paris, France, 18–21 February 2015.

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Table 1—Outcomes of CSII during 9-year follow-up

	Duration of insulin pump therapy (years)								
	1	2	3	4	5	6	7	8	9
Number of patients	161	122	105	85	70	57	37	23	17
Decrease in HbA_{1c} from baseline (% [mmol/mol])	−1.3 ± 1.8 (14.2 ± 19.7)	−1.3 ± 1.9 (14.2 ± 20.8)	−1.3 ± 1.7 (14.2 ± 18.6)	−1.4 ± 2.0 (15.3 ± 21.9)	−1.5 ± 1.9 (16.4 ± 20.8)	−1.0 ± 2.0 (10.9 ± 21.9)	−1.6 ± 2.0 (17.5 ± 21.9)	−1.5 ± 2.1 (16.4 ± 23.0)	−1.4 ± 2.1 (15.3 ± 23.0)
Mean increase in weight from baseline (kg)	2.9 ± 7.6	3.7 ± 8.1	3.8 ± 8.9	4.8 ± 9.8	4.0 ± 10.9	6.1 ± 11.0	2.9 ± 10.4	8.7 ± 10.1	7.6 ± 11.0
Total daily insulin dose (units/kg/day)	1.01 ± 0.54	0.97 ± 0.55	0.98 ± 0.48	1 ± 0.48	0.96 ± 0.47	1.18 ± 0.49	1.19 ± 0.78	1.19 ± 0.49	1.16 ± 0.6
Cumulative number of deaths	3	6	8	9	10	11	13	14	15
Cumulative number of pump arrests	1	12	29	22	22	25	25	27	27
Cumulative number of patients lost to follow-up	0	1	2	3	3	3	5	6	6

Data are mean ± SD unless otherwise indicated.