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Closing the loop in end-stage renal disease patients with type 2 diabetes receiving dialysis

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Background/Introduction:

Glucose control in patients with diabetes and end-stage renal disease requiring dialysis is characterised by brittle glycaemic fluctuations due to complex alterations in glucose/insulin homeostasis, making its management highly challenging. There is a clear need for improved delivery of care and novel approaches to optimise diabetes management in this vulnerable population. Closed-loop insulin therapy continuously modulates insulin delivery on the basis of real-time sensor glucose values and may therefore benefit glucose control in patients with diabetes receiving dialysis.

Methods:

As part of an ongoing study, seven outpatients with type 2 diabetes receiving haemodialysis at the University Hospital Bern were treated with fully closed-loop insulin therapy and conventional insulin therapy in random order. The fully closed-loop insulin therapy consisted of the CAM APS HX system (Android smartphone, Dexcom G6, DANA RS pump) with a glucose target set at 7.0mmol/l. Study periods lasted 20 days each and were separated by a 2-4 week wash-out period. The primary outcome was the proportion of time when sensor glucose was in target range (3.9-10.0mmol/l). Data for both treatments are presented as median and interquartile range [IQR] and treatment differences were assessed using linear mixed-effect models with treatment and period considered fixed and subjects random effects.

Results:

The results of this preliminary analysis suggest a higher proportion of time when sensor glucose concentration was in target range using closed-loop compared with control (63.1% [60.4%; 67.2%] versus 52.0% [20.6%; 57.4%], p=0.04). Compared with control, closed-loop reduced the proportion of time spent in hyperglycaemia (36.9% [32.4%; 39.9%] vs 46.5% [40.5; 79.3]], p=0.04) and mean sensor glucose (9.5mmol/L [9.1; 9.6] vs 10.3mmol/L [9.1; 13.5], p=0.04). The proportion of time spent in hypoglycaemia was low during both treatment arms (0.0% [0.0%; 1.2%] during closed-loop and 0.1% [0.0%; 0.2%] during control) with no significant treatment difference. Sensor availability was 99% [95%; 100%] and closed-loop was operative during 91% [88%; 92%] of the time. There were no serious adverse events in either condition.

Conclusion:

Preliminary data assessing the use of fully automated closed-loop insulin delivery in outpatients with type 2 diabetes receiving haemodialysis shows great promise in improving glucose control in this vulnerable population without increasing the risk of hypoglycaemia.