Title: Clinical Advances in Automated Insulin Delivery: Lessons from Diverse Patient Populations and Care Environments

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Advanced hybrid closed-loop (AHCL) insulin delivery systems, such as the Medtronic 780G, are transforming diabetes management across various clinical contexts. We present integrated findings from three distinct cohorts, demonstrating the versatility and impact of AHCL systems in challenging environments.

In the ICU, five critically ill patients with diverse diabetes types were successfully managed using AHCL instead of intravenous insulin, achieving time-in-range (TIR) levels up to 100% without hypoglycemia. This approach reduced staff burden and supported metabolic stabilization even during complex nutritional support.

In long-term care, a 63-year-old woman with type 1 diabetes and PEG-dependent enteral feeding was treated with AHCL for over one year. After individualized adjustments, TIR improved to 80% with minimal hypoglycemia, enabling reduced feeding volumes and insulin needs. This highlights AHCL's feasibility and the necessity of tailored algorithm settings and staff training in fully dependent patients.

Among five patients with type 1 diabetes and severe psychiatric comorbidities, AHCL therapy led to significant improvements in HbA1c, increased TIR (up to 87%), and reduced substance abuse. Enhanced metabolic control contributed to improved mental health and fewer hospitalizations, emphasizing the interplay between glycemic stability and psychological well-being.

Collectively, these experiences illustrate that AHCL systems can achieve safe and stable glycemic control while improving quality of life across highly diverse and complex care environments. Our findings encourage broader implementation and patient-centered adaptations of AID systems in routine clinical practice.

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