

Siphon Effects on Continuous Subcutaneous Insulin Infusion Pump Delivery Performance

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Abstract

Background:

The objective was to quantify hydrostatic effects on continuous subcutaneous insulin infusion (CSII) pumps during basal and bolus insulin delivery.

Methods:

We tested CSII pumps from Medtronic Diabetes (MiniMed 512 and 515), Smiths Medical (Deltec Cozmo 1700), and Insulet (OmniPod) using insulin aspart (Novolog, Novo Nordisk). Pumps were filled and primed per manufacturer's instructions. The fluid level change was measured using an inline graduated glass pipette (100 μ l) when the pipette was moved in relation to the pump (80 cm Cosmo and 110 cm Medtronic) and when level. Pumps were compared during 1 and 5 U boluses and basal insulin delivery of 1.0 and 1.5 U/h.

Results:

Pronounced differences were seen during basal delivery in pumps using 80–100 cm tubing. For the 1 U/h rate, differences ranged from 74.5% of the expected delivery when the pumps were below the pipettes and pumping upward to 123.3% when the pumps were above the pipettes and pumping downward. For the 1.5 U/h rate, differences ranged from 86.7% to 117.0% when the pumps were below or above the pipettes, respectively. Compared to pumps with tubing, OmniPod performed with significantly less variation in insulin delivery.

Conclusions:

Changing position of a conventional CSII pump in relation to its tubing results in significant changes in insulin delivery. The siphon effect in the tubing may affect the accuracy of insulin delivery, especially during low basal rates. This effect has been reported when syringe pumps were moved in relation to infusion sites but has not been reported with CSII pumps.

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Abbreviations: (CSII) continuous subcutaneous insulin infusion

Keywords: continuous subcutaneous insulin infusion, insulin administration, insulin delivery, insulin infusion, insulin infusion devices, insulin pump therapy

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