

Improved pharmacokinetic and pharmacodynamic profile of rapid-acting insulin using needle-free jet injection technology

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Abstract

Objective: Insulin administered by jet injectors is dispensed over a larger subcutaneous area than insulin injected with a syringe, which may facilitate a more rapid absorption. This study compared the pharmacologic profile of administration of insulin aspart by jet injection to that by conventional insulin pen.

Research design and methods: Euglycemic glucose clamp tests were performed in 18 healthy volunteers after subcutaneous administration of 0.2 units/kg body wt of aspart, either administered by jet injection or by conventional pen, using a randomized, double-blind, double-dummy, cross over study design.

Pharmacodynamic and pharmacokinetic profiles were derived from the glucose infusion rate (GIR) needed to maintain euglycemia and from plasma insulin levels, respectively.

Results: The time to maximal GIR was significantly shorter when insulin was injected with the jet injector compared with conventional pen administration (51 ± 3 vs. 105 ± 11 min, $P < 0.0001$). The time to peak insulin concentration was similarly reduced (31 ± 3 vs. 64 ± 6 min, $P < 0.0001$) and peak insulin concentrations were increased (108 ± 13 vs. 79 ± 7 mU/L, $P = 0.01$) when insulin was injected by jet injection compared with conventional pen injection. Jet injector insulin administration reduced the time

to 50% glucose disposal by ~40 min ($P < 0.0001$). There were no differences in maximal GIR, total insulin absorption, or total insulin action between the two devices.

Conclusions: Administration of insulin aspart by jet injection enhances insulin absorption and reduces the duration of glucose-lowering action. This profile resembles more closely the pattern of endogenous insulin secretion and may help to achieve better meal insulin coverage and correction of postprandial glucose excursions.

Figures

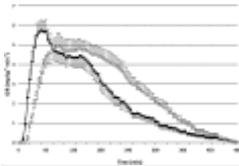


Figure 1

Mean GIR after administration of...

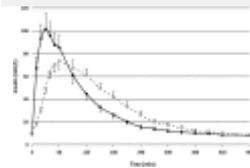


Figure 2

Mean plasma insulin levels after...