

The output of infusion pumps can be predictably controlled and coordinated by a computer-executed algorithm in a model of neonatal/pediatric drug infusions” Parker et al (2017).

Abstract:

BACKGROUND: Laboratory data suggest that newly initiated drug infusions reach steady-state delivery after a significant time lag. Depending on drug and carrier flow rates and the infusion system’s common volume, lag times may exceed 20 or more minutes, especially in the neonatal/pediatric critical care environment. This study tested the hypothesis that a computer-executed algorithm controlling infusion pumps in a coordinated fashion predictably hastens the achievement of the intended steady-state drug delivery in a model of neonatal/pediatric drug infusion.

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METHODS: We constructed an in vitro model of neonatal/pediatric drug infusions through a pediatric 4-Fr central venous catheter at total system flows of 2 mL/h or 12 mL/h, representing a clinically relevant infusion range. Methylene blue served as the model infused drug for quantitative analysis. A novel algorithm, based on Taylor Dispersion Theory of fluid flow through tubes and executed by a computer, generated flow patterns that controlled and coordinated drug and carrier delivery by syringe pumps. We measured the time to achieve the intended steady-state drug delivery by conventional initiation of the drug infusion (“turning on the drug pump”) and by algorithm-controlled infusion initiation.

RESULTS: At 2 mL/h total system flow, application of the algorithm reduced the time to achieve half of the intended drug delivery rate (T50) from 17 minutes [17, 18] to 3 minutes [3, 3] (median, interquartile range). At 12 mL/h total system flow, application of the algorithm reduced T50 from 6 minutes [6, 7] to 3 minutes [3, 3]. The bootstrapped median difference is -14 (95% confidence interval, -16 to -12, adjusted P=.00192) for 2 mL/h flow and -3 (95% CI, -4 to -3, adjusted P=.02061) for 12 mL/h flow. Compared with conventional initiation, the additional fluid required by the algorithm-directed infusion was 0.43 and 1.03

mL for the low- and high-infusion rates, respectively.

CONCLUSIONS: The output of infusion pumps can be predictably controlled and coordinated by a computer-executed algorithm in a model of neonatal/pediatric drug infusions. Application of an algorithm can reduce the time to achieve the intended rate of infused drug delivery with minimal incremental volume administration.

Reference:

Parker, M.J., Lovich, M.A., Tsao, A.C., Deng, H., Houle, T. and Peterfreund, R.A. (2017) Novel Pump Control Technology Accelerates Drug Delivery Onset in a Model of Pediatric Drug Infusion. *Anesthesia and Analgesia*. February 8th. .

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