Multiport catheters and catheters with a porous surface have been proposed for intraparenchymal infusions of therapeutics in fluid suspensions" Raghavan and Odland (2017).

Abstract:

Multiport catheters and catheters with a porous surface have been proposed for intraparenchymal infusions of therapeutics in fluid suspensions. Target diseases include brain cancer and serious neurodegenerative diseases, as well as peripheral tumors, for example in the prostate and the liver. We set up the theory for infusions from such devices, in particular the fluid flow equations which demand a coupling between the flow within the catheter and that in tissue. (Such a coupling is not necessary in the theory of infusion from single port catheters.) The new feature of such catheters, treated by our model, is revealed by infusions into inhomogeneous media.

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Multiport designs have the potential to overcome the limitation of single port catheters, for which the path of the fluid leaving the port is dominated by the inhomogeneities. We solve these equations for some simple cases to illustrate the key design features of porous catheters that show such advantages. The mathematics required for numerical solution with more realistic assumptions is also developed. We confirm the robustness of such catheters, when the ports are sufficiently resistive, against leakage paths that would compromise the infusions from catheters with one or a few large ports. The methods of this paper can be incorporated into a larger planning system for intraparenchymal infusions involving such devices.

Reference:

Raghavan, R. and Odland, R.M. (2017) Theory of porous catheters and their applications in intraparenchymal infusions. Biomedical Physics & Engineering Express. 3(2).

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