MICROCATHETER WITH DISTAL TIP PORTION AND PROXIMAL SOLUTION LUMEN

FIELD OF THE INVENTION

[001] The present invention is directed to a microcatheter having a tip portion for holding a guidewire therein, and a proximal body having a solution lumen.

[002] More specifically, the present invention is directed to a microcatheter which is designed to hold solution such as a contrast solution or a therapeutic or diagnostic solution in a proximal lumen, and simultaneously hold a guidewire in a distal tip lumen, and which can be used to inject solution into a vessel while manipulating the guidewire or the microcatheter in the vessel.

BACKGROUND OF THER INVENTION

[003] Microcatheters are commonly used by physicians to access discreet regions of the arterial vasculature during interventional procedures. They are typically used to facilitate the placement and exchange of guidewires, and may also be used to subselectively infuse or deliver therapeutic agents. Some examples of microcatheters are Skyway® and Minnie® (Vascular Solutions, Inc.), Rebar®, Nautica™ and Echelon™ (ev3, Inc.), Quick-Cross® Select (Spectranetics, Inc.), Tracker® Excel™ (Boston Scientific, Inc.) and Corsair® (Asahi Intecc) all of which are single lumen catheters, with the lumen sized to have a substantially close fit with a guidewire placed therethrough in order to provide support to the guidewire. These devices may be comprised of a single or multiple-layer polymer shaft, or a polymer shaft with a stainless steel braid. To perform perfusion of diagnostic or therapeutic agents, the guidewire must be removed from the lumen, and this may result in a loss of access to the distal vasculature.

SUMMARY OF THE INVENTION

[004] There is provided, in accordance with embodiments of the present invention, a microcatheter for providing support to advance a movable guidewire through a vessel or an occlusion within the vessel and for simultaneously providing

means for local perfusion of a solution. The microcatheter includes an elongate tubular body having a body proximal end, a body distal end and a solution lumen extending

axially through the elongate tubular body. The elongate tubular body has a body inner diameter. The elongate tubular body has an outlet port at the body distal end. The outlet port is configured to introduce a solution from the solution lumen into a vessel. The microcatheter further includes a tip portion having a tip portion proximal end distal to the outlet port, a tip portion distal end, and a tip portion lumen extending axially through the tip portion. The tip portion is at least 10mm in length. The tip portion has a tip portion inner diameter which is smaller than the body inner diameter. The tip portion has a proximal opening at the tip portion proximal end. The microcatheter further includes a movable guidewire positioned in the tip portion. The tip portion lumen is sized for a substantially close fit for athe guidewire to be held therein. The tip portion inner diameter is sized so as to provide a tight fit for the guidewire along an entire length of the tip portion thus providing for minimization of a distal portion of the microcatheter and enhanced pushability and maneuverability of the guidewire such that the guidewire may be advanced and manipulated within the vessel past the tip portion while also being supported by the tip portion. While the movable guidewire is positioned within the tip portion, the solution from the solution lumen is configured to exit through the outlet port and into the vessel ~~and has a diameter which is smaller than a diameter of the elongate tubular body~~.

[005] In accordance with further features in embodiments of the invention, the microcatheter may further include a spine wire extending along a length of the elongate tubular body and bonded thereto and further at least partially connected to the tip portion. . The tip portion proximal end may be positioned distal to the outlet port of the elongate tubular body. In some embodiments, the elongate tubular body is continuous with the tip portion and configured to hold a proximal portion of the guidewire therein. In other embodiments, the tip portion is separate from the tubular body, and may be eccentric thereto. In some embodiments, the tip portion has a proximal opening at the tip portion proximal end, and the proximal opening is not co-linear with the outlet port. The tip portion may be at least partially radiopaque, and may have a length of 10mm-120mm. An inner diameter of the tip portion may be approximately 0.002" larger than a diameter of a guidewire to be placed therethrough, or may be any size such that a tight fit is provided around the

guidewire. In some embodiments, a balloon may be positioned on the distal tip portion, wherein the balloon may be made of a compliant material, or a semi-compliant material, depending on the application. The balloon may be positioned on a proximal end of the tip portion, on a distal end of the tip portion, or anywhere in between depending on the application.

There is provided, in accordance with another embodiment of the present invention, a microcatheter. The microcatheter includes an elongate tubular body having a body proximal end, a body distal end, and a solution lumen extending axially through said elongate tubular body, the elongate tubular body having an outlet port at the body distal end, and a tip portion having a tip portion proximal end, a tip portion distal end, and a tip portion lumen extending axially through the tip portion, the tip portion lumen sized for a substantially close fit for a guidewire to be held therein, wherein the tip portion has a proximal opening at the

CLAIMS

1. A microcatheter for providing support to advance a movable guidewire through a vessel or an occlusion within the vessel and for simultaneously providing means for local perfusion of a solution, the microcatheter comprising:

an elongate tubular body having a body proximal end, a body distal end and a solution lumen extending axially through said elongate tubular body, said elongate tubular body having a body inner diameter, said elongate tubular body comprising an outlet port ~~in said solution lumen~~ at said body distal end, said outlet port configured to introduce a solution from said solution lumen into a vessel; and

a tip portion having a tip portion proximal end distal to said outlet port, a tip portion distal end and a tip portion lumen extending axially through said tip portion, wherein said tip portion is at least 10mm in length, and wherein said tip portion has a ~~smaller~~tip portion inner diameter which is smaller than said body inner diameter, wherein said tip portion has a proximal opening at said tip portion proximal end; and

~~than the elongate tubular body and is continuous with the elongate tubular body and wherein the tip portion lumen has a smaller inner diameter than the solution lumen and is continuous with the solution lumen~~

a movable guidewire positioned in said tip portion, said tip portion lumen sized for a substantially close fit for the guidewire to be held therein, wherein the tip portion inner diameter is sized so as to provide a tight fit for the guidewire along an entire length of the tip portion thus providing for minimization of a distal portion of the microcatheter and enhanced pushability and maneuverability of the guidewire such that the guidewire may be advanced and manipulated within the vessel past the tip portion while also being supported by the tip portion, and while the movable guidewire is positioned within the tip portion, the solution from said solution lumen is configured to exit through said outlet port and into the vessel.

~~2. The microcatheter of claim 1, wherein said tip portion proximal end is positioned distal to said outlet port of said elongate tubular body.~~

~~3~~2. The microcatheter of claim 1, wherein said elongate tubular body ~~is~~ and said solution lumen are continuous with said tip portion~~, and is configured to hold a proximal portion of a movable guidewire therein~~.

43. The microcatheter of claim 1, wherein said tip portion is eccentric to said elongate tubular body.

54. The microcatheter of claim 1, wherein said tip portion is at least partially radiopaque.

~~6~~5. The microcatheter of claim ~~5~~4, wherein said tip portion is comprised of a polymer compounded with radiopaque material.

~~7~~6. The microcatheter of claim 1, wherein said tip portion is in a range of 10 mm to 120 mm long.

~~8~~7. The microcatheter of claim 1, wherein an inner diameter of said tip portion is approximately 0.002" (0.0508 mm) larger than a diameter of ~~a~~ the guidewire to be placed therethrough.

~~9~~8. The microcatheter of claim 1, wherein said outlet port comprises multiple openings.

~~10~~9. The microcatheter of claim 1, wherein said outlet port comprises an opening at said body distal end, wherein said opening leads directly into ~~a blood~~ the vessel.

~~11~~10. The microcatheter of claim 1, further comprising a balloon positioned on said ~~distal~~ tip portion distal end.

~~12~~11. The microcatheter of claim ~~11~~10, wherein said balloon is comprised of a compliant material.

~~13~~12. The microcatheter of claim ~~11~~10, wherein said balloon is comprised of a semi-compliant material.

~~14~~13. The microcatheter of claim 1, further comprising a spine wire extending along a length of said elongate tubular body and bonded thereto, said spine wire further at least partially connected to said tip portion.

~~15. A microcatheter comprising:~~

~~an elongate tubular body having a body proximal end, a body distal end, and a solution lumen extending axially through said elongate tubular body, said elongate tubular body comprising an outlet port at said body distal end; and~~

~~a tip portion having a tip portion proximal end, a tip portion distal end, and a tip portion lumen extending axially through said tip portion, said tip portion lumen sized for a substantially close fit for a guidewire to be held therein wherein an inner diameter of said tip portion is approximately 0.002" larger than a diameter of a guidewire to be placed therethrough so as to provide a tight fit for the guidewire thus providing for minimization of the distal portion of the microcatheter and enhanced pushability and maneuverability of the guidewire, wherein said tip portion has a proximal opening at said tip portion proximal end and wherein said tip portion is eccentric to said elongate tubular body and wherein said proximal opening of said tip portion is not co-linear with said outlet port.~~

~~16. The microcatheter of claim 15, wherein said elongate tubular body and said tip portion have substantially the same diameter.~~

~~17. The microcatheter of claim 15, wherein said tip portion proximal end is positioned distal to said outlet port of said elongate tubular body.~~

~~18. The microcatheter of claim 15, wherein said tip portion is at least partially radiopaque.~~

~~19. The microcatheter of claim 18, wherein said tip portion is comprised of a polymer compounded with radiopaque material.~~

~~20. The microcatheter of claim 15, wherein said tip portion is in a range of 10 mm to 120 mm long.~~

14. The microcatheter of claim 1, wherein said outlet port at said body distal end is positioned within said solution lumen.

15. The microcatheter of claim 1, wherein said elongate tubular body is configured to hold a proximal portion of the movable guidewire therein.

16. The microcatheter of claim 1, wherein said tip portion is in a range of 10 mm to 90 mm.

17. The microcatheter of claim 1, wherein said proximal opening of said tip portion is not co-linear with said outlet port.