

Claims

1. A cannula structure configured for cannulating an anatomical vessel, the cannula structure comprising:

- 5 a first tube having an elongate length and a lumen therethrough for channeling a fluid, the first tube having a distal fluid input configured for receiving the fluid, a first segment having a first lumen therethrough aligned with the lumen of the first tube wherein the first segment is configured for residing entirely internal to the cannulated anatomical vessel, and a plurality of fluid outputs coupled to the distal fluid input and configured for discharging the fluid into the vessel, wherein
- 10 the plurality of fluid outputs comprises:
- an exit opening disposed near or at a proximal end of the first segment, the exit opening configured for outputting or discharging a first portion of the fluid into the vessel along a first fluid flow direction from the exit opening;
- a plurality of fenestrations carried by distal portions of the first segment along portions of
- 15 a length of the first segment and about portions of a circumference of the first segment, the plurality of fenestrations configured for outputting or discharging a second portion of the fluid into the vessel such that the second portion of the fluid flows along a second fluid flow direction from the plurality of fenestrations opposite to the first fluid flow direction; and
- 20 an anchoring assembly including at least one structure that is distally carried by the first segment near or adjacent to the plurality of fenestrations, and which is outwardly or radially displaceable away from the lumen beyond an exterior surface of the first segment,
- wherein at least one of (a) the plurality of fenestrations and (b) the at least one outwardly or radially displaceable structure is arranged obliquely with respect to a lengthwise axis of the first
- 25 segment or the first fluid flow direction.

2. The cannula structure of claim 1, wherein the plurality of fenestrations is configured to output the second portion of fluid flow in multiple directions having a vector fluid flow component in the second fluid flow direction.
- 5 3. The cannula structure of claim 1, wherein the plurality of fenestrations comprises a first fenestration that is disposed distally away from a second fenestration.
4. The cannula structure of claim 1, wherein each of (a) the plurality of fenestrations and (b) the at least one outwardly or radially displaceable element is disposed in an oblique arrangement with respect to the
10 lengthwise axis of the first segment or the first fluid flow direction.
5. The cannula structure of claim 1, wherein the plurality of fenestrations is disposed around at most half of the circumference of the first segment.
- 15 6. The cannula structure of claim 5, wherein the plurality of fenestrations is disposed in a lower region of a lower half of the circumference of the first segment.
7. The cannula structure of claim 1, wherein the anchoring assembly is configured for selectively displacing the at least one outwardly or radially displaceable structure away from or toward the first
20 lumen.
8. The cannula structure of claim 7, wherein the at least one outwardly or radially displaceable structure when outwardly or radially displaced has a cross sectional area that is larger than a cross sectional area of the first segment.
- 25 9. The cannula structure of claim 7, wherein anchoring assembly comprises a pressurizable, expandable, or inflatable cuff.

10. The cannula structure of claim 9, wherein the cuff is carried external to the first lumen of the first segment such that the cuff is exposed to the fluid in the vessel.

5 11. The cannula structure of claim 9, wherein the cuff is coupled to a plurality of flange members that are outwardly or radially displaceable away from the first lumen in response to pressurization, expansion, or inflation of the cuff.

12. The cannula structure of claim 11, wherein the plurality of flange members is disposed in an oblique
10 arrangement with respect to the lengthwise axis of the first segment or the first fluid flow direction.

13. The cannula structure of claim 1, wherein the anchoring assembly comprises a slidably displaceable switch coupled to a plurality of thin flexible strips of material, wherein the at least one structure comprises a plurality of petals, and wherein each of the petals is coupled to or formed from end portions of a
15 corresponding strip of material.

14. The cannula structure of claim 13, wherein the plurality of petals is disposed in an oblique arrangement with respect to the lengthwise axis of the first segment or the first fluid flow direction.

20 15. The cannula structure of claim 1, further comprising a flow indicator assembly comprising: a fluid indicator port carried by the first segment; a fluidic channel coupled to the flow indicator port, the fluidic channel comprising a transparent or translucent material capable of providing a visual indication of a flow of fluid from the vessel into the fluid indicator port; and a luminous portion disposed along the fluidic channel, the luminous portion carrying a substance capable of reacting with the fluid within the fluidic
25 channel to thereby enhance the visual indication of the flow of fluid in the fluidic channel.

16. The cannula structure of claim 1, wherein the first tube further comprises at least one visible marking

aligned with at least one fenestration, the visible marking adapted to provide a visual indication of contortion of the first tube.

17. The cannula structure of claim 16, wherein the at least one visible marking comprises a plurality of
5 visible markings each of which corresponds to a position of a fenestration of the plurality of fenestrations.

18. The cannula structure of claim 1, wherein at least some of the plurality of fenestrations are disposed on an angulatable material carried by the first segment.

10 19. The cannula structure of claim 1, wherein the first tube further comprises a second segment having a second lumen aligned with the first lumen, the second segment distal to the first segment, the second segment configured to substantially entirely reside external to the vessel when the vessel is cannulated, wherein the first and second lumens form the lumen of the first tube.

15 20. The cannula structure of claim 1, further comprising a second tube configured for mating engagement with the first tube and which serves as a dilator relative to the first tube.

21. The cannula structure of claim 1, wherein the cannula structure is configured for proximal infusion of blood into proximal portions of the vessel by way of the exit opening concurrent with maintaining distal
20 perfusion of blood into distal portions of the vessel to thereby distally deliver blood to a target organ or tissue by way of the plurality of fenestrations.