

CLAIMS

What is claimed is:

1. An intravascular blood pump (200), comprising:
 - a catheter (204) configured for insertion into a blood vessel (205) that defines an interior volume (207) through which blood flows in a blood flow direction (208);
 - a pump housing (211) attached to the catheter (204) and defining an input port (214) and an output port (216);
 - an impeller (212) disposed within the pump housing (211) and configured, when rotating, to pump blood from the input port (214) to the output port (216); and
 - an outflow hose (234) in fluid communication with the output port (216) of the pump housing (211), the outflow hose (234) defining a discharge port (238) that is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) and in fluid communication with the interior volume (207) of the blood vessel (205).
2. An intravascular blood pump (200) according to claim 1, wherein the outflow hose (234) is coaxial with the catheter (204).
3. An intravascular blood pump (200) according to any previous claim, wherein effective inside cross-sectional area (502) of the outflow hose (234) is at least as large as effective inside cross-sectional area (700) of the input port (214) of the pump housing (211).
4. An intravascular blood pump (200) according to any previous claim, wherein effective inside cross-sectional area (502) of the outflow hose (234) is greater than effective inside cross-sectional area (700) of the input port (214) of the pump housing (211).
5. An intravascular blood pump (200) according to any previous claim, wherein effective inside cross-sectional area (502) of the outflow hose (234) is at least two times effective inside cross-sectional area (700) of the input port (214) of the pump housing (211).

6. An intravascular blood pump (200) according to any previous claim, wherein effective inside cross-sectional area (502) of the outflow hose (234) is greater than effective inside cross-sectional area (502) of the pump housing (211).
7. An intravascular blood pump (200) according to any previous claim, wherein the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) by at least about 50 mm.
8. An intravascular blood pump (200) according to any previous claim, wherein the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) by at least about 80 mm.
9. An intravascular blood pump (200) according to any previous claim, wherein the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) by at least about 100 mm.
10. An intravascular blood pump (200) according to any one of claim 1-6, wherein the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) by about 50-150 mm.
11. An intravascular blood pump (200) according to any one of claim 1-6, wherein the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (240), in a downstream direction relative to the blood flow direction (208), from the output port (216) of the pump housing (211) by about 80-120 mm.
12. An intravascular blood pump (200) according to any previous claim, wherein the outflow hose (234) is at least about 50 mm long.

13. An intravascular blood pump (200) according to any one of claim 1-11, wherein the outflow hose (234) is at least about 80 mm long.
14. An intravascular blood pump (200) according to any one of claim 1-11, wherein the outflow hose (234) is at least about 100 mm long.
15. An intravascular blood pump (200) according to any one of claim 1-11, wherein the outflow hose (234) is at between about 50 mm long and about 150 mm long.
16. An intravascular blood pump (200) according to any one of claim 1-11, wherein the outflow hose (234) is at between about 80 mm long and about 120 mm long.
17. An intravascular blood pump (200) according to any previous claim, wherein the outflow hose (234) is radially collapsible (600) and/or radially expandable (500) and configured to increase in radius at least about 25% from an initial radius in response to blood pressure generated by the impeller (212), when the impeller (212) pumps blood, and to at least partially collapse (600) for lack of blood pressure, when the impeller (212) pumps no blood.
18. An intravascular blood pump (200) according to any previous claim, further comprising a first pressure sensor (300) disposed on the pump housing (211), outside the outflow hose (234).
19. An intravascular blood pump (200) according to any previous claim, further comprising a second pressure sensor (302) disposed inside the outflow hose (234).
20. An intravascular blood pump (200) according to any previous claim, wherein the output port (216) of the pump housing (211) comprises a plurality of apertures defined circumferentially around the pump housing (211).
21. An intravascular blood pump (200) according to any one of claim 1-19, wherein the output port (216) of the pump housing (211) comprises a plurality of apertures defined along a plurality of rows (1600-1604), wherein the rows (1600-1604) are spaced apart longitudinally along the outflow hose (234).

22. An intravascular blood pump (200) according to any previous claim, wherein the input port (214) of the pump housing (211) comprises a cannula (226) extending longitudinally in an upstream direction, relative to the blood flow direction (208), to an intake port (228) defined by the cannula (226), the intake port (228) being in fluid communication with the interior volume (207) of the blood vessel (205).
23. An intravascular blood pump (200) according to claim 22, wherein a portion (400) of the cannula (226) that defines the intake port (228) is radially expandable to a diameter larger than an outside diameter of the pump housing (211).
24. An intravascular blood pump (200) according to any previous claim, wherein the cannula (226) defines an intake port (230), and the discharge port (238) of the outflow hose (234) is longitudinally spaced apart (236), in a downstream direction relative to the blood flow direction (208), from the intake port (230) of the cannula (226) by at least about 90 mm.
25. An intravascular blood pump (200) according to any previous claim, further comprising an electric motor (220) disposed in the pump housing (211), mechanically coupled to the impeller (212) and configured to rotate the impeller (212).
26. An intravascular blood pump (200) according to any previous claim, further comprising a drive shaft (224) disposed in the catheter (204), mechanically coupled to the impeller (212) and configured to transfer rotational energy to the impeller (212) from a motor external to the intravascular blood pump (200).