

CLAIMS

1. An intravascular blood pump for percutaneous insertion into a patient's vasculature,
5 the intravascular blood pump comprising a pumping device (30) and a supply line (36),
 - wherein the pumping device (30) comprises a pump section (32) having a blood flow inlet (33), a blood flow outlet (34) and an impeller rotatable about an axis of rotation for conveying blood from the blood flow inlet to the blood flow outlet, and a drive section (31) connected to the pump section (32) and adapted to drive the impeller, and
 - 10 - wherein the supply line (36) is adapted to supply energy for driving the impeller, and
 - wherein an anchoring structure (60; 70) is provided at a distal end region of the intravascular blood pump.
2. The intravascular blood pump according to claim 1, wherein the anchoring structure
15 comprises a hook or loop (60) at an axial end (30A) of the distal end region.
3. The intravascular blood pump according to claim 2, wherein the loop (60) is made from a soft, elastic material and forms an atraumatic distal extension at the axial end of the intravascular blood pump.
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4. The intravascular blood pump according to claim 3, wherein the loop (60) is provided at an atraumatic distal extension (40) of the intravascular blood pump.
5. The intravascular blood pump according to any one of claims 2 to 4, wherein the
25 anchoring structure comprises a neck-and-head structure at an axial end (30A) of the distal end region.
6. The intravascular blood pump according to claim 5, wherein a connecting surface (72) between a head (70) and a neck (71) of the neck-and-head structure is inclined by 90° relative to a longitudinal axis of the intravascular blood pump, or the connecting surface (72) is
30 inclined by more than 90° relative to the longitudinal axis of the intravascular blood pump so as to form an undercut.

7. The intravascular blood pump according to claim 5 or 6, wherein the neck-and-head structure is formed in a recess of the end region.
8. The intravascular blood pump according to claim 5 or 6, wherein the neck-and-head structure is formed at an end of an atraumatic distal extension (40).
9. An introducer set, comprising an intravascular blood pump according to any one of claims 1 or 4 to 10 and a connecting catheter (25) which comprises a connector adapted to connect to the anchoring structure (60; 70) of the intravascular blood pump.
10. The introducer set according to claim 9, wherein the connector comprises a hook adapted to hook into the anchoring structure of the intravascular blood pump.
11. The introducer set according to claim 9, the connector comprises a gripper having a first grip (26A) and a second grip (26B) adapted to close or grip around the anchoring structure of the intravascular blood pump.
12. The introducer set according to claim 11, wherein the gripper has a gripping surface (26C), wherein the gripping surface is inclined by 90° relative to a longitudinal axis of the connecting catheter.
13. The introducer set according to claim 11, wherein the gripper has a gripping surface (26C), wherein the gripping surface is inclined by more than 90° relative to the longitudinal axis of the connecting catheter so as to form an undercut.
14. The intravascular blood pump according to any one of claims 1 to 13, wherein the anchoring structure comprises at least one anchor adapted to anchor the intravascular blood pump in a wall of a patient's blood vessel.
15. The intravascular blood pump according to claim 14, wherein the anchor (41) comprises spikes that are expandable and collapsible.
16. A kit for placing an intravascular blood pump in a patient comprising the following tools:

- a transseptal sheath (17), which may include a puncture tip end or separate puncture needle and a dilator,
- a first guide wire (20A),
- a second guide wire (20B),
- 5 - an introducer sheath (19),
- a snare catheter (18),
- a balloon catheter (22),
- a maneuverable catheter (23),
- either a connecting catheter (25) or a tube (24).

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17. A method of placing an intravascular blood pump in a patient, the blood pump comprising a pump section having a blood flow inlet and a blood flow outlet and an impeller rotatable about an axis of rotation and sized and shaped for conveying blood from the blood flow inlet to the blood flow outlet, the blood pump further comprising a supply line,
- 15 preferably a supply catheter, connected to the pump section and adapted to supply energy, preferably electric energy, for driving the impeller, the method comprising the steps of:
- placing a first guide wire through the patient's vascular system, including through the patient's heart, such that it extends out of the patient's body with a first end through a first percutaneous access on an arterial side of the vascular system, preferably through the axillary
 - 20 artery or subclavian artery, and with a second end through a second percutaneous access on a venous side of the vascular system, preferably through the subclavian vein or axillary vein, and
 - using the first guide wire in the further procedure of placing the intravascular blood pump into the patient's body through the second percutaneous access.

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18. The method of claim 17, comprising one or more of the following steps:
- inserting a transseptal sheath from the venous side of the patient's vascular system through a passage created in the septum of the patient's heart into the left side of the heart, and advancing the first end of the first guide wire through the transseptal sheath into the left
 - 30 part of the heart and pulling back the transseptal sheath,
 - wherein preferably the transseptal sheath is inserted through a third percutaneous access into a vein below the vena cava inferior, preferably a femoral vein, and further comprising the steps of: inserting a snare catheter through the second percutaneous access into a vein above the vena cava superior, advancing the snare catheter into the vena cava superior towards the

first guide wire, catching the first guide wire with the snare catheter, and moving the second end of the first guide wire into the third percutaneous access and out of the second percutaneous access with the aid of the snare catheter,

- expanding the passage through the septum, preferably using a balloon catheter,
- 5 - advancing an introducer sheath through the septum, preferably with the aid of the balloon catheter, such that a front part of the introducer sheath extends into the left part of the heart, preferably into the left ventricle,
- withdrawing the balloon catheter, where applicable,
- advancing a maneuverable catheter, preferably a Swan-Ganz catheter, through the
- 10 introducer sheath into the left part of the heart, preferably into the left ventricle,
- preferably, advancing a second guide wire through the first percutaneous access into the left part of the heart, preferably into the left ventricle, and
- guiding the first end of the first guide wire towards and out of the first percutaneous access with the aid of the maneuverable catheter, preferably by inflating a balloon of the
- 15 Swan-Ganz catheter and following the patient's blood flow, preferably along a direction which is indicated by the second guide wire.

19. The method of claim 18, comprising one or more of the following steps:

- attaching, preferably in a form-fitting manner, a front end of a coupling catheter to the
- 20 first end of the first guide wire and guiding the coupling catheter through the patient's vascular system, including through the patient's heart, using the first guide wire until the front end of the coupling catheter extends through the second percutaneous access out of the patient's body, preferably while simultaneously withdrawing the maneuverable catheter from the patient's body,
- 25 - coupling a distal end of the intravascular blood pump to the coupling catheter, preferably in a form-fitting manner, and advancing the intravascular blood pump through the patient's vascular system, including through the septum, so as to place the pump section into the left part of the heart, preferably across the aortic valve,
- preferably, anchoring the intravascular blood pump in a wall of a blood vessel,
- 30 preferably in an aortic wall, preferably by moving a plurality of spikes from a circumference of the intravascular blood pump from a radially collapsed configuration to a radially expanded configuration to engage the wall of the blood vessel,
- decoupling the coupling catheter from the distal end of the intravascular blood pump and withdrawing the coupling catheter from the patient's body, and

- withdrawing the introducer sheath from the patient's body.

20. The method of claim 18, comprising one or more of the following steps:

- withdrawing the maneuverable catheter from the patient's body while keeping the first
5 end of the first guide wire extending through the second percutaneous access out of the patient's body,
 - guiding the introducer sheath along the first guide wire through the patient's vascular system, including through the patient's heart, until the front end of the introducer sheath extends through the second percutaneous access out of the patient's body,
- 10 - feeding the second end of the first guide wire through a loop provided at a distal end of the intravascular blood pump and advancing the second end of the first guide wire through the introducer sheath until the second end of the first guide wire extends out of the front end of the introducer sheath,
 - gripping the first end second ends of the first guide wire which extend through the
15 second percutaneous access out of the introducer sheath and advancing the intravascular blood pump along the introducer sheath through the patient's vascular system, including through the septum, so as to place the pump section into the left part of the heart, preferably across the aortic valve,
- releasing or unfeeding the first guide wire from the loop provided at the distal end of the
20 intravascular blood pump and withdrawing the first guide wire from the introducer sheath,
 - withdrawing the introducer sheath from the patient's body, and
 - preferably, anchoring the intravascular blood pump in a wall of a blood vessel, preferably in an aortic wall, preferably by moving a plurality of spikes from a circumference of the intravascular blood pump from a radially collapsed configuration to a radially expanded
25 configuration to engage the wall of the blood vessel.

21. A method of placing an intravascular blood pump in a patient, the blood pump comprising a pumping device, the pumping device comprising a pump section having a blood flow inlet and a blood flow outlet and an impeller rotatable about an axis of rotation and sized
30 and shaped for conveying blood from the blood flow inlet to the blood flow outlet, and a drive section connected to the pump section and adapted to drive the impeller, the blood pump further comprising a supply line, preferably a supply catheter, connected to the pumping device and adapted to supply the drive section at least with energy, preferably electric energy, for driving the impeller, the method comprising the steps of:

- accessing the patient's thoracic cavity;
 - creating a puncture through an apical wall of the heart of the patient to access the left ventricle of the heart;
 - advancing the pumping device through the puncture in the apical wall such that the
- 5 blood flow inlet of the pump section is disposed in the left ventricle of the heart, the blood flow outlet of the pump section is disposed in the patient's aorta, the supply line extends through the puncture in the apical wall out of the patient's body, and the drive section is disposed in the aorta.
- 10 22. The method of claim 21, comprising the step of anchoring the intravascular blood pump in a wall of a blood vessel, preferably in an aortic wall, preferably by moving a plurality of spikes from a circumference of the intravascular blood pump from a radially collapsed configuration to a radially expanded configuration to engage the wall of the blood vessel.