Claims

1. A system for mapping innervated areas in a renal artery based on the position(s) of electrodes on a catheter, comprising:

~~1.~~ ~~A~~(i) a catheter ~~for mapping renal nerves distributed on a renal blood vessel~~, comprising:

a catheter tip comprising a plurality of bipolar electrodes;

said plurality of bipolar electrodes are disposed along said catheter tip to form at least one loop at a section of said renal artery, wherein an electrical stimulation can be delivered between any pair of bipolar electrodes among said plurality of bipolar electrodes to identify a reference site at said section;

(ii) one or more measuring devices for measuring one or more physiological parameters associated with innervation of said renal artery;

(iii) a computing device coupled to said one or more measuring devices and is configured for computing any increase or decrease in the physiological parameters against a baseline; and

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(iv) a display device for displaying the location or identity of a parasympathetic or sympathetic nerve innervating said reference site, said location is based on the position(s) of electrodes on said catheter; wherein said display device comprises a display screen showing results of electrical stimulation applied between any pair of electrodes among said plurality of electrodes.

2. The ~~catheter~~system of claim 1, wherein said plurality of electrodes cover one-third the length of said renal blood vessel.

3. The ~~catheter~~system of claim 1, wherein said catheter tip comprises a plurality of resilient members (3003) having said plurality of electrodes, each of said plurality of resilient members (3003) has a distal end and a proximal end, wherein

said distal end is attached to a controlling rod (3005) and said proximal end is attached to a separation rod (3006); said separation rod (3006) moves freely from the controlling rod (3005); or

said distal end is attached to a separation rod (3006) and the proximal end is attached to a controlling sheath (3007); said controlling sheath houses said controlling rod (3005) and said separation rod (3006).

4. The ~~catheter~~system of claim 3, wherein each of said plurality of resilient members (3003) comprises a flat part (3101) and a bending part (3102).

5. The ~~catheter~~system of claim 4, wherein said resilient member comprises a mechanism for concentrating bending at the bending parts, said mechanism comprises:

having a kink at where the flat part (3101) joins the bending parts (3102);

said flat part being stiffer than said bending parts; or

said bending parts being thinner than said flat part.

6. The ~~catheter~~system of claim 1, wherein said catheter tip comprises a distal segment and a proximal segment, said plurality of electrodes are separated into a set of distal electrodes on said distal segment and a set of proximal electrodes on said proximal segment.

7. The ~~catheter~~system of claim 6, wherein said set of distal electrodes are located on a set of distal resilient members and said set of proximal electrodes are located on a set of proximal resilient members, wherein

each of said distal resilient members has a distal end connected to a controlling rod and a proximal end connected to a connecting ring which sheaths said controlling rod;

each of said proximal resilient members has a distal end connected to said connecting ring and a proximal end connected to a controlling sheath;

said connecting ring moves passively along the controlling rod based on the force balance between said distal and proximal set of resilient members.

8. The ~~catheter~~system of claim 1, said catheter tip comprises a controlling rod, a controlling sheath and one or more resilient members (3105) with wavy preformed shape, wherein said one or more resilient members comprises a distal end and a proximal end, said distal end is attached to said controlling rod and the proximal end is attached to a controlling sheath.

9. The ~~catheter~~system of claim 8, wherein said one or more resilient members (3105) with wavy preformed shape comprises one or more points contacting said controlling rod, wherein at least one of said one or more points contacting said controlling rod comprises a connecting ring.

10. The ~~catheter~~system of claim 1, wherein said plurality of electrodes is adapted for delivering ablative energy.

11. The ~~catheter~~system of claim 1, wherein said at least one loop has a diameter of 2 to 15 mm.

~~12. A system for mapping innervated areas in a renal artery based on the position(s) of electrodes on a catheter, comprising:~~

~~(i) the catheter of claim 1;~~

~~(ii) one or more measuring devices for measuring one or more physiological parameters associated with innervation of said renal artery;~~

~~(iii) a computing device coupled to said one or more measuring devices and is configured for computing any increase or decrease in the physiological parameters against a baseline; and~~

~~(iv) a display device for displaying the location or identity of a parasympathetic or sympathetic nerve innervating said renal artery, said location is based on the position(s) of electrodes on said catheter.~~

~~13. The system of claim 12, wherein said display device comprises a display screen showing results of electrical stimulation applied between any pair of electrodes among said plurality of electrodes.~~