

Claims

1. A prostatic treatment apparatus for treating a prostate in a body of a patient, the prostate generally surrounding a urethra which is connected to a bladder of the patient, the apparatus comprising:

a urethral catheter including:

a proximal portion having a first port and a second port each configured to be positioned external to the body of the patient;

a distal portion having an inflatable balloon configured to be advanced via the urethra into the bladder and in fluid communication with the first port; and

a lumen extending from the second port to proximate the distal portion, the lumen having a cross-sectional shape;

an electrode assembly including:

a shaft configured to be slidably received within lumen of the urethral catheter, the shaft having a cross-sectional shape that interlocks with the cross-sectional shape of the lumen to inhibit rotation of the shaft within the lumen, and a plurality of channels defined within the shaft, each channel having a corresponding extendable electrode disposed therein;

a proximal portion having a collar at a proximal end of the shaft that is configured to interface with the second port when the electrode assembly is slidably received within the lumen, a flange structure protruding from the collar, and an electrode actuator proximal of the flange structure, the electrode actuator operably connected to a proximal portion of the extendable electrodes and configured to control linearly actuation of the extendable electrodes, wherein the collar and the electrode actuator are interfaced via a keyed structure to inhibit rotation of the electrode actuator relative to the collar; and

an electrode tip at a distal end of the shaft and having a plurality of ports defined therein, each port interfacing with a corresponding channel in the lumen and configured to project a distal end of the corresponding extendable electrode outward through the urethral catheter and into the prostate in response to linear actuation of the electrode actuator, the corresponding extendable electrode being extended in a predefined rotational orientation relative to the keyed structure; and

a power source electrically coupled to the extendable electrodes and configured to deliver direct current to the prostate when the extendable electrodes are extended into the prostate to promote necrosis of the prostate via an electrolytic reaction.

2. The prostatic treatment apparatus of claim 1, wherein the electrode actuator includes a ring structure configured to enable a thumb of a user to be at least partially inserted therein, wherein the flange structure is configured to interface with one or more fingers of the user, and wherein the linear actuation of the extendable electrodes is controlled by the user manipulating the ring relative to the flange.

3. The prostatic treatment apparatus of claim 1, further comprising a disengagable stop configured to inhibit actuation of the electrode actuator relative to the collar.

4. The prostatic treatment apparatus of claim 1, further comprising a fastener configured to secure the electrode assembly relative to the urethral catheter when the electrode assembly is slidingly received within the urethral catheter.

5. The prostatic treatment apparatus of claim 1, further comprising a second inflatable balloon configured to be positioned outside the urethra and in fluid communication with the first port.

6. The prostatic treatment apparatus of claim 1, the power source comprises:
a source of the electricity;
a controller for the source of the electricity; and
a monitor configured to generate electrical parameter information indicative of an electrical parameter associated with electricity supplied to the plurality of extendable electrodes, wherein the controller is configured to control the electricity supplied to the plurality of extendable electrodes depending on the electrical parameter information.

7. The prostatic treatment apparatus of claim 6, wherein the controller is configured to change the electricity during the electrolytic generation of at least one of the necrotizing base and the necrotizing acid within the prostate.

8. The prostatic treatment apparatus of claim 1, wherein each of the plurality of extendable electrodes comprises an electrode within an insulating sheath defining at least two uninsulated distal portions of the electrode that are configured to be extended out of the electrode tip.
9. The prostatic treatment apparatus of claim 1, further comprising a channel in one of the urethral catheter and the electrode assembly configured to introduce a chemical into the prostate proximate at least one of the plurality of extendable electrodes.
10. The prostatic treatment apparatus of claim 1, wherein at least one of the plurality of extendable electrodes is configured to be extended further into the prostate than at least another one of the plurality of extendable electrodes.
11. The prostatic treatment apparatus of claim 1, wherein the cross-sectional shape of the lumen of the urethral catheter and the cross-sectional shape of the shaft of the electrode assembly are corresponding D-shapes.
12. The prostatic treatment apparatus of claim 1, wherein the electrode tip is replaceable, and the apparatus includes a plurality of different replaceable electrode tips, each electrode tip having the plurality of ports positioned to provide a different predefined rotational orientation of the ports relative to the keyed structure.
13. The prostatic treatment apparatus of claim 1, wherein the shaft of the electrode assembly further comprises an anti-torsion strip extending along the shaft, the anti-torsion strip having a generally rectangular cross-sectional shape with an aspect ratio of greater than 4 to 1 and made of a material stiffer than a material of the shaft to increase torsion resistance of the shaft.
14. The prostatic treatment apparatus of claim 13, wherein the anti-torsion strip is made of a metal material and is configured to be selectively pre-formed into a curved longitudinal shape prior to insertion of the electrode assembly into the urethral catheter.
15. The prostatic treatment apparatus of claim 1, wherein the urethral catheter further includes a second lumen extending from the distal portion to the proximal portion and having an anti-stretch device disposed therein made of a material that is stiffer than a material of the urethral catheter to

decrease a longitudinal stretch of the urethral catheter in response to the linear actuation of the electrode actuator.

16. The prostatic treatment apparatus of claim 15, wherein the anti-stretch device is made of a metal material and is configured to be selectively pre-formed into a curved longitudinal shape prior to insertion of the urethral catheter into the urethra.

17. The prostatic treatment apparatus of claim 1, wherein shaft of the electrode assembly further comprises a sleeve assembly that is over-jacketed about the shaft to retain the extendable electrodes within the corresponding channel.

18. A prostatic treatment apparatus for treating a prostate in a body of a patient, the prostate generally surrounding a urethra which is connected to a bladder of the patient, the apparatus comprising:

a urethral catheter including:

a proximal portion having a first port and a second port each configured to be positioned external to the body of the patient;

a distal portion having an inflatable balloon configured to be advanced via the urethra into the bladder and in fluid communication with the first port; and

a lumen extending from the second port to proximate the distal portion, the lumen having a cross-sectional shape;

an electrode assembly including:

a shaft configured to be slidably received within lumen of the urethral catheter, the shaft having:

a cross-sectional shape that interlocks with the cross-sectional shape of the lumen to inhibit rotation of the shaft within the lumen,

a plurality of channels defined within the shaft, each channel having a corresponding extendable electrode disposed therein,

an anti-torsion strip extending along the shaft, the anti-torsion strip having a generally rectangular cross-sectional shape and made of a metal material stiffer than a material of the shaft to increase torsion resistance of the shaft, and

a sleeve assembly that is over-jacketed about the shaft to retain the extendable electrodes and the anti-torsion strip within the shaft;

a proximal portion having a collar at a proximal end of the shaft that is configured to interface with the second port when the electrode assembly is slidably received within the lumen, and an electrode actuator operably connected to a proximal portion of the extendable electrodes and configured to control linearly actuation of the extendable electrodes, wherein the collar and the electrode actuator are interfaced via a keyed structure to inhibit rotation of the electrode actuator relative to the collar, and wherein the corresponding extendable electrode being extended in a predefined rotational orientation relative to the keyed structure; and

an electrode tip at a distal end of the shaft and having a plurality of ports defined therein, each port interfacing with a corresponding channel in the lumen and configured to project a distal end of the corresponding extendable electrode outward through the urethral catheter and into the prostate in response to linear actuation of the electrode actuator; and

a power source electrically coupled to the extendable electrodes and configured to deliver direct current to the prostate when the extendable electrodes are extended into the prostate to promote necrosis of the prostate via an electrolytic reaction.

19. The prostatic treatment apparatus of claim 18, wherein the urethral catheter further includes a second lumen extending from the distal portion to the proximal portion and having an anti-stretch device disposed therein made of a material that is stiffer than a material of the urethral catheter to decrease a longitudinal stretch of the urethral catheter in response to the linear actuation of the electrode actuator.

20. The prostatic treatment apparatus of claim 19, wherein the anti-stretch device is made of a metal material and at least one of the anti-torsion strip and the anti-stretch device is configured to be selectively pre-formed into a curved longitudinal shape prior to insertion into the urethra.