CLAIMS

We claim

1. An interventional medical device for retrieving and securing an obstruction within a vessel lumen, the device comprising:

   a shaft having a flexibility to navigate through tortuous anatomy, the shaft a distal portion and a proximal portion;

   a capturing structure located at a distal portion of the shaft comprising a plurality of struts, the capturing structure having a reduced profile for positioning in or adjacent to the obstruction and an expanded profile, such that when expanded into the obstruction, the struts at least partially enmesh with the obstruction such that subsequent movement of the capturing structure permits dislocation of at least a portion of the obstruction from the lumen;

   an eversible cover having a fixed section affixed relative to a proximal end of the capturing structure, a free section extending in a proximal direction from the fixed section and a cover wall extending from the fixed section to the free section, where the eversible cover is expandable, the eversible cover being axially compliant such that when the shaft is moved proximally within the lumen, the eversible cover everts over the capturing structure allowing for the free section of the cover to be distal to the fixed end of the capturing portion.

2. The medical device of claim 1, where the eversible cover, capturing structure, and shaft are a unitary structure.

3. The medical device of claim 1, where each wire located at an end of the free section loops back to the cover causing the wires at the end of the free section to be continuous.

4. The medical device of claim 1, where at least a portion of the cover wall adjacent to the distal end has a set shape that is everted upon expansion.

5. The medical device of claim 1, further comprising a catheter body, where in a delivery configuration, the shaft, capturing structure and eversible cover are located within the catheter body and where the capturing structure is advanceable in and out of a distal end of the catheter body.

6. The medical device of claim 1, where the eversible cover comprises a plurality of layers forming the cover wall.

7. The medical device of claim 1, where the free section of the eversible cover partially restricts about the shaft without being attached to the shaft.

8. The medical device of claim 1, where a portion of the cover wall extends distally beyond the fixed section when the eversible cover is expanded.

9. The medical device of claim 1, where the fixed section of the eversible cover comprises a pre-set shape to reduce a force required to evert the evertable cover.

10. The medical device of claim 1, where the cover wall is layered in an undulating pattern upon deployment.

11. The medical device of claim 1, where the capturing structure comprises an elongated stent structure.

12. The medical device of claim 1, where the capturing structure comprises a device selected from a group consisting of a filter, an artherectomy device, a rotational cutter, an aspiration device, stent based retrievers and retrieval baskets.

13. The medical device of claim 1, where the cover is self expanding.

14. The medical device of claim 1, where a portion of the cover at or adjacent to the distal opening comprises a bulbous shape.

15. The medical device of claim 1, where the cover comprises a first porous section having a first porosity and at least a second porous section having a second porosity, where the first and second porosity are different such that the ability of fluid to flow through the first porous section and second porous section differs.

16. The medical device of claim 15, where the first porous section comprises a first braid density and the second porous section comprises a second braid density.

17. The medical device of claim 15, where the first porous section comprises an additional braid layer.

18. The medical device of claim 15, where the first porous section prevents fluid from flowing therethrough.

19. The medical device of claim 15, where the first porous section is distal to the second porous section and where the first porosity is greater than the second porosity.

20. The medical device of claim 15, where the first porous section comprises a circumferential area of the cover.

21. The medical device of claim 1, further comprising at least one polymeric layer on or adjacent to a region of the cover.

22. The medical device of claim 21, further comprising at least one medicament on or in the polymeric layer.

23. The medical device of claim 1, further comprising at least one radiopaque marker on a distal end of the shaft.

24. The medical device of claim 1, where the cover comprises a mesh material

25. The medical device of claim 24, where the mesh material comprises a single continuous wire.

26. The medical device of claim 24, where at least a portion of the mesh material is fabricated from a drawn filled tube material.

27. The medical device of claim 24, where at least a portion of the mesh material is fabricated from a radiopaque material.

28. The medical device of claim 1, where the eversible cover comprises at least one wire coiled such that turns of the coil form the cover wall.

29. The medical device of claim 28, where the cover further comprises a braid adjacent to the coil.

30. The medical device of claim 28, where the cover further comprises a film coupled to the coil.

31. The medical device of claim 1, where the eversible cover comprises at least one barb or knuckle at an exterior surface of the cover wall.

32. The medical device of claim 1, where the eversible cover comprises an inner braided layer and an outer braided layer, where the outer braided layer is relatively more compliant than the inner braided layer.

33. A method of securing an obstruction within a vessel, the method comprising:

positioning a catheter within a vessel;

advancing a shaft having a retrieval device affixed thereto out of the catheter;

advancing an eversible cover out of the catheter such that a fixed end of the eversible cover is adjacent to a proximal end of the retrieval device and a free end of the eversible cover is moveable relative to the shaft and retrieval device;

expanding at least a portion of the eversible cover against a portion of a wall of the vessel;

manipulating the retrieval device to become at least partially enmeshed with the obstruction; and

proximally translating the shaft and retrieval device with at least a portion of the obstruction affixed thereto such that resistance of the eversible cover against the vessel resists movement of the eversible cover causing the free section of the eversible cover to evert over the proximally translated retrieval device.

34. The method of claim 33, further comprising further withdrawing the shaft from the vessel such that during withdrawal the eversible cover forms a protective barrier over the obstruction to lessen shearing forces caused by the vessel and reduce dislodging portions of the obstruction from the retrieval device.

35. A method of preparing a retrieval device comprising:

providing a retrieval device *having been previously removed from a body of a patient* where the retrieval device includes a protective cover where a fixed end of the protective cover is affixed adjacent to a proximal end of the retrieval device and where a free end is located distally to the fixed end covering the retrieval device and is moveable relative to the second end;

reversing the protective cover by moving the free end proximally of the fixed while the fixed end remains affixed adjacent to the proximal end of the retrieval device;

inserting the retrieval device and cover into a catheter where the free end of the cover is proximal to the fixed end of the cover and retrieval device such that upon deployment from the catheter, the free end of the cover deploys proximally to the fixed end of the cover.

36. A method of securing an obstruction within a vessel, the method comprising:

advancing a shaft having a retrieval device affixed thereto to the obstruction;

advancing a protective device over the shaft, the protective device comprising a sheath having an eversible cover, where a fixed end of the eversible cover is affixed to a distal portion of the sheath and a free end of the eversible cover is located proximal to the fixed end;

positioning the fixed end of the eversible cover adjacent to the retrieval device and expanding at least a portion of the eversible cover against a portion of a wall of the vessel;

proximally translating the shaft and retrieval device with at least a portion of the obstruction affixed thereto such that resistance of the eversible cover against the vessel resists movement of the eversible cover causing the free section of the eversible cover to evert over the proximally translated retrieval device.

37. A medical device retrieval system for securing an obstruction within a vessel lumen and for use with a catheter configured to be navigated through the vasculature, the device comprising:

an elongated stent comprising a plurality of struts, the stent being collapsible for positioning in the catheter during delivery and having an expanded profile such that when expanded the struts are configured to engage the obstruction;

a shaft fixedly attached to the elongated stent and having a flexibility to navigate through tortuous anatomy;

a fluid permeable cover having a distal end coupled to a proximal end of the elongated stent a cover wall defining a cavity and extending along the shaft, and a proximal end being moveable relative to the shaft, where the fluid permeable cover is collapsible for positioning in the catheter during delivery and is expandable upon deployment from the catheter such that a portion of the fluid permeable cover is expandable;

where the fluid permeable cover is axially pliable such that when the device is deployed in the vessel and frictional forces are applied against the fluid permeable cover, proximal movement of the shaft and elongated stent cause inversion of the fluid

permeable cover wall such that the fluid permeable cover wall everts over the elongated stent.

38. An interventional medical device for use with a catheter configured for delivery through vasculature and for securing an obstruction within a vessel lumen, the device comprising:

a shaft having a flexibility to navigate through tortuous anatomy, the shaft having a distal portion and a proximal portion;

a capturing device comprising a sidewall, the capturing device fixedly located at a distal portion of the shaft and having a reduced profile for positioning in the catheter and an expanded profile, such that upon deployment from the catheter, the capturing device expands to force a portion of the sidewall into the obstruction to at least partially attach to the obstruction;

a cover having a distal end coupled adjacent to a proximal end of the capturing structure, a proximal end and a cover wall extending therebetween, where the proximal end of the cover is slidable relative to the distal end, where the cover is expandable such that when located in the catheter the cover is in a reduced delivery state and upon advancement from the catheter the cover expands with the proximal end located proximally of the distal end, where the cover wall is compliant such that when deployed from the catheter and the shaft is pulled in a proximal direction frictional forces between the vessel and the cover wall or proximal end cause the cover to invert as the cover wall inverts over the capturing device to surround the capturing device.

39. An interventional medical device for securing a retrieval device having one or more obstructions located therein for removal from a body, the medical device comprising:

a sheath having a flexibility to navigate through tortuous anatomy, the sheath a distal portion and a proximal portion and a lumen extending therethrough;

an eversible cover having a fixed section affixed to the distal portion of the sheath, a free section extending in a proximal direction from the fixed section and a cover wall extending from the fixed section to the free section, where the eversible cover is expandable, the eversible cover being axially compliant such that when the retrieval device is positioned through the sheath lumen and moved in a proximal direction against the eversible cover, the eversible cover everts over the retrieval device allowing for the free section of the cover to be distal to the retrieval device.

40. A stent retrieval device for expanding against one or more occlusive bodies in a vasculature, the stent retrieval device comprising:

an elongate shaft having a flexibility to navigate through tortuous anatomy, the elongate shaft having a distal portion and a proximal portion;

a plurality of filaments that diverge from the distal portion of the elongate shaft to form an expandable elongated stent body having a open distal end and a fluid permeable closed proximal end and a cavity therebetween, where divergence of the filaments at the distal portion of the elongate shaft forms the fluid permeable closed proximal end;

where the plurality of filaments extending along the shaft are free of any connection joints in the distal portion to permit increased flexibility of the distal portion as it navigates though tortuous anatomy; and

one or more connection joints proximal to the distal portion where the connection joints secure the plurality of filaments to the shaft.

41. The stent retrieval device of claim 40, wherein at least one of the plurality of filaments comprise at least two wires twisted together, the elongated stent body further comprising at least one intersection of filaments, where the wires of each filament are interwoven to provide increased outward radial strength of the elongated stent body and such that the wires slide relative to each other as the elongated stent body expands or compresses in diameter to reduce a force required to linearize the elongated stent body.

42. The stent retrieval device of claim 40, where the exterior surface of the elongated stent body comprises an irregular surface formed by intersection of filaments.

43. The stent retrieval device of claim 42, where the intersection of filaments comprises a barb or knuckle and where a plurality of barbs or knuckles are radially spaced about the elongated stent body.

44. The stent retrieval device of claim 42, where the intersection of filaments comprises a barb or knuckle and where a plurality of barbs or knuckles are aligned with an axis of the elongated stent body.

45. The stent retrieval device of claim 42, where the elongated stent body comprises a plurality of barbs or knuckles radially spaced about the elongated stent body and a plurality of barbs or knuckles axially aligned with an axis of the elongated stent body.

46. The stent retrieval device of claim 40, where at least one filament comprises a drawn filled tube material.

47. The stent retrieval device of claim 40, where at least one filament comprises at least one wire comprised of a first material and at least a second wire comprised of at least a second material different from the first material.

48. The stent retrieval device of claim 40, where at least one filament comprises at least one wire comprised of a first material and at least a second filament having at least one wire comprised of at least a second material different from the first material.

CLAIMS

We claim:

1. A medical device for securing a vascular device for removal from a body, the medical device comprising:

a shaft having a flexibility to navigate through tortuous anatomy, the shaft having a distal portion and a proximal portion and a lumen extending therethrough; and

an eversible cover having a fixed section affixed near an end of the distal portion of the shaft, a free section extending in a proximal direction from the fixed section and an eversible cover wall extending from the fixed section to the free section, where on deployment in a vessel the eversible cover wall expands against a vessel wall and is fluid permeable to permit flow therethrough, the eversible cover being axially compliant such that when the vascular device retrieval device is positioned through the shaft lumen and moved in a proximal direction, the friction of the eversible cover against the vessel wall causes the eversible cover to completely evert over the vascular device in a conveyor belt type manner allowing for the free section of the eversible cover to be distal to the vascular device; and

where the eversible cover wall is configured to expand outward upon deployment in the vessel and to collapse inward after everting and compress an obstruction.

2. The medical device of claim 1, the fixed section of the eversible cover is affixed at the end of the distal portion of the shaft.

3. The medical device of claim 1, where at least a portion of the eversible cover wall adjacent to the distal end has a set shape that is everted upon expansion.

4. The medical device of claim 1, where the eversible cover comprises a plurality of layers forming the eversible cover wall.

5. The medical device of claim 1, where a portion of the eversible cover wall extends distally beyond the fixed section when the eversible cover is expanded.

6. The medical device of claim 1, where the fixed section of the eversible cover comprises a pre-set shape to reduce a force required to evert the eversible cover.

7. The medical device of claim 1, where the lumen of the shaft is sized to permit advancement of the shaft over a wire of the vascular device.

8. The medical device of claim 7, where the vascular device comprises an elongated stent structure.

9. The medical device of claim 7, where the vascular device comprises a device selected from a group consisting of a filter, an artherectomy device, a rotational cutter, an aspiration device, stent based retrievers, balloon and retrieval baskets.

10. The medical device of claim 1, where the eversible cover is self expanding.

11. The medical device of claim 1, where a portion of the eversible cover at or adjacent to the free section of the eversible cover comprises a bulbous shape.

12. The medical device of claim 1, where the eversible cover comprises a mesh material.

13. The medical device of claim 12, where the mesh material comprises a single continuous wire.

14. The medical device of claim 1, where the eversible cover comprises an inner braided layer and an outer braided layer, where the outer braided layer is relatively more compliant than the inner braided layer.

15. The medical device of claim 1, where the eversible cover is configured to taper or collapse towards the free end after everting.

16. A medical device for securing a vascular device for removal from a body, the medical device comprising:

a shaft having a distal portion and a proximal portion and a lumen extending therethrough; and

an eversible cover having a fixed section affixed near an end of the distal portion of the shaft, a free section extending in a proximal direction from the fixed section and an eversible cover wall extending from the fixed section to the free section, where on deployment in a vessel the eversible cover wall expands against a vessel wall, the eversible cover being axially compliant such that when the vascular device is positioned through the shaft lumen distally to the eversible cover and moved in a proximal direction, the friction of the eversible cover against the vessel wall and the axial compliance of the eversible cover allows the eversible cover to secure the vascular device by movement of the fixed section of the eversible cover proximally,

allowing the eversible cover to completely evert over the vascular device such that the free section of the eversible cover moves distal to the vascular device; and

where the eversible cover wall is configured to expand outward upon deployment in the vessel and to collapse inward after everting and compress the obstruction.

17. The medical device of claim 16, the fixed section of the eversible cover is affixed at the end of the distal portion of the shaft.

18. The medical device of claim 16, where at least a portion of the eversible cover wall adjacent to the distal end has a set shape that is everted upon expansion.

19. The medical device of claim 16, where the eversible cover comprises a plurality of layers forming the eversible cover wall.

20. The medical device of claim 16, where a portion of the eversible cover wall extends distally beyond the fixed section when the eversible cover is expanded.

21. The medical device of claim 16, where the fixed section of the eversible cover comprises a pre-set shape to reduce a force required to evert the eversible cover.

22. The medical device of claim 16, where the lumen of the shaft is sized to permit advancement of the shaft over a wire of the vascular device.

23. The medical device of claim 22, where the vascular device comprises an elongated stent structure.

24. The medical device of claim 22, where the vascular device comprises a device selected from a group consisting of a filter, an artherectomy device, a rotational cutter, an aspiration device, stent based retrievers, balloon and retrieval baskets.

25. The medical device of claim 16, where a portion of the eversible cover at or adjacent to the free section of the eversible cover comprises a bulbous shape.

26. The medical device of claim 16, where the eversible cover comprises a mesh material.

27. The medical device of claim 26, where the mesh material comprises a single continuous wire.

28. The medical device of claim 16, where the eversible cover comprises an inner braided layer and an outer braided layer, where the outer braided layer is relatively more compliant than the inner braided layer.

29. The medical device of claim 16, where the eversible cover is configured to taper or collapse towards the free end after everting.

30. A medical device for securing a vascular device for removal from a body, the medical device comprising:

a shaft having a flexibility to navigate through tortuous anatomy, the shaft having a distal portion and a proximal portion and a lumen extending therethrough; and

an eversible cover having a fixed section affixed near an end of the distal portion of the shaft, a free section extending in a proximal direction from the fixed section and an eversible cover wall extending from the fixed section to the free section, where on deployment in a vessel the eversible cover wall expands against a vessel wall and is fluid permeable to permit flow therethrough, the eversible cover being axially compliant such that the friction of the eversible cover against the vessel wall and the axial compliance of the eversible cover allows the eversible cover to secure the vascular device by movement of the fixed section of the eversible cover proximally causing the eversible cover to evert over the vascular device to move the free section of the eversible cover distal to the vascular device; and

where the eversible cover wall is configured to expand outward upon deployment in the vessel and to collapse inward after everting and compress the obstruction.