

Claims

What is claimed is:

1. An endoscopic system configurable to be provided in a cavity of a patient, the endoscopic system comprising:

a first main body, the first main body being an elongated body, the first main body including:

a first end, the first end of the first main body located at a distal end of the first main body, the first end of the first main body controllable to bend in a plurality of directions;

a first anchor assembly at the first end of the first main body, the first anchor assembly including:

a first expandable member secured to the first main body, the first expandable member configurable to expand radially away from the first main body;

a second expandable member secured to the first main body, the second expandable member configurable to expand radially away from the first main body; and

a first negative pressure opening provided on the first main body between the first expandable member and the second expandable member, the first negative pressure opening configurable to apply a negative pressure;

wherein the first expandable member, the second expandable member, and the first negative pressure opening are configured to cooperate to sufficiently anchor the first main body to an interior wall forming a colonic lumen so as to withstand a force of at least 0.1 N when the first and second expandable members are expanded radially away from the first main body and the first negative pressure opening applies a negative pressure;

a second main body, the second main body being an elongated body having a main cavity, the main cavity housing at least a portion of the first main body and not housing at least a portion of the first end of the first main body, the second main body including:

a first end, the first end of the second main body located at a distal end of the second main body, the first end of the second main body controllable to bend in a plurality of directions, wherein the bending of the first end of the second main body is controllable independently from the bending of the first end of the first main body;

a second anchor assembly at the first end of the second main body, the second anchor assembly including:

a third expandable member secured to the second main body, the third expandable member configurable to expand radially away from the second main body; and

a second negative pressure opening provided on the second main body, the second negative pressure opening configurable to apply a negative pressure, wherein the third expandable member is positioned between the second negative pressure opening and a most distal portion of the first end of the second main body; and

a head assembly, the head assembly being an elongated body, the head assembly including:

a first end portion and second end portion opposite to the first end portion of the head assembly, at least a portion of the first end portion of the head assembly housed within and adjacent the first end of the first main body, wherein a length of the head assembly is between about 10-100 mm, wherein at least a portion of the head assembly that extends outwardly away from the first end of the first main body is configurable to bend in a plurality of directions, wherein the bending of the portion of the head assembly that extends outwardly away from the first end of the first main body is controllable independently from the bending of the first end of the first main body; and

a suction/irrigation opening provided at the most distal portion of the second end portion of the head assembly, the suction/irrigation opening configurable to enable an exchange of fluids and/or solids between an exterior of the most distal portion of the second end portion of the head assembly and the endoscopic system;

wherein the first main body and second main body are configurable to slide relative to one another in such a way that a length of the first main body that extends outwardly away from the first end of the second main body is adjustable; and

wherein the head assembly and first main assembly are configurable to slide relative to one another in such a way that a length of the head assembly that extends outwardly away from the first end of the first main body is adjustable.

2. The endoscopic system of claim 1, further comprising a pressure control subsystem configurable to provide the negative pressure through the first negative pressure opening.
3. The endoscopic system of claim 1, wherein the expanding of the first expandable member corresponds with the negative pressure applied through the first negative pressure opening.
4. The endoscopic system of claim 1, wherein an exterior surface of one or more of the first and second expandable members include a surface pattern, roughness, and/or protrusion, the surface pattern, roughness, and/or protrusion configured to resist a movement of one or more of the first and second expandable members with respect to the interior wall forming the cavity of the patient when one or more of the first and second expandable members are in contact with.
5. The endoscopic system of claim 1, wherein the head assembly further comprises a plurality of movement control cavities, each movement control cavity configurable to receive a filler; and

wherein the second end portion is actuated in the plurality of directions by selectively controlling the filler in one or more of the plurality of movement control cavities.

6. The endoscopic system of claim 1, wherein the head assembly further comprises an image capturing assembly, the image capturing assembly configurable to capture an image.

7. The endoscopic system of claim 1, wherein the head assembly is configurable to provide an instrument at the second end portion of the head assembly, the instrument for use in performing an in vivo procedure in the cavity of the patient.

8. The endoscopic system of claim 1, wherein the first main body further comprises a plurality of cavities, including a first cavity and a second cavity, the first cavity operable to provide a filler to expand the first expandable member, and the second cavity in communication with the pressure control subsystem and the suction opening.

9. The endoscopic system of claim 1, wherein:

the second anchor assembly further includes:

a fourth expandable member secured to the second main body and provided in such a way that the second negative pressure opening is provided between the third expandable member and the fourth expandable member, the fourth expandable member configurable to expand radially away from the second main body.

10. The endoscopic system of claim 1, further comprising a pressure control subsystem configurable to provide a negative pressure through the second negative pressure opening.

11. The endoscopic system of claim 10, wherein an exterior surface of one or more of the third and fourth expandable members include a surface pattern, roughness, and/or protrusion, the surface pattern, roughness, and/or protrusion configured to resist a movement of one or more of the third and fourth expandable members with respect to the interior wall forming the cavity of the patient when one or more of the third and fourth expandable members are in contact with the interior wall forming the cavity of the patient.

12. The endoscopic system of claim 6, further comprising a controller in communication with the head assembly, the controller operable to control the image capturing assembly, the controller further operable to actuate the direction of the second end portion of the head assembly.
13. The endoscopic system of claim 12, wherein the actuating the direction of the second end portion of the head assembly is based on the image captured by the image capturing assembly and/or a sensor provided at the second end portion of the head assembly.
14. The endoscopic system of claim 12, wherein the controller is further operable to control the instrument provided at the second end portion of the head assembly to perform the in vivo procedure in the cavity of the patient.
15. The endoscopic system of claim 14, wherein the controlling of the instrument to perform the in vivo procedure in the cavity of the patient is based on the image captured by the image capturing assembly and/or the sensor provided at the second end portion of the head assembly.
16. The endoscopic system of claim 1, further comprising a controller in communication with the anchor assembly, the controller operable to control the expanding of the first expandable member and the second expandable member.
17. The endoscopic system of claim 1, wherein at least a portion of the head assembly is fixedly secured to the first end of the first main body.
18. The endoscopic system of claim 1, wherein the first negative pressure opening is configurable to apply a negative pressure of a magnitude of at least 10 kPa.
19. An endoscopic system, the endoscopic system comprising:
a first main body, the first main body being an elongated body, the first main body including:

a first end, the first end of the first main body located at a distal end of the first main body;

a plurality of movement control cavities for the first main body, including a first movement control cavity and a second movement control cavity, the first movement control cavity controllable so as to cause the first end of the first main body to bend in a first direction, the second movement control cavity controllable so as to cause the first end of the first main body to bend in a second direction different from the first direction;

a first anchor assembly at the first end of the first main body, the first anchor assembly including:

a first expandable member secured to the first main body, the first expandable member configurable to expand radially away from the first main body;

a second expandable member secured to the first main body, the second expandable member configurable to expand radially away from the first main body;
and

a first negative pressure opening provided on the first main body between the first expandable member and the second expandable member, the first negative pressure opening configurable to apply a negative pressure;

wherein the first expandable member, the second expandable member, and the first negative pressure opening are configured to cooperate to sufficiently anchor the first main body to an interior wall forming a colonic lumen so as to withstand a force of at least 0.1 N when the first and second expandable members are expanded radially away from the first main body and the first negative pressure opening applies a negative pressure;

a second main body, the second main body being an elongated body having a main cavity, the main cavity housing at least a portion of the first main body and not housing at least a portion of the first end of the first main body, the second main body including:

a first end, the first end of the second main body located at a distal end of the second main body;

a plurality of movement control cavities for the second main body, including a third movement control cavity and a fourth movement control cavity, the third movement control cavity controllable so as to cause the first end of the second main body to bend in a third direction, the fourth movement control cavity controllable so as to cause the first end of the second main body to bend in a fourth direction different from the third direction, wherein the bending of the first end of the second main body is controllable independently from the bending of the first end of the first main body;

a second anchor assembly at the first end of the second main body, the second anchor assembly including:

a third expandable member secured to the second main body, the third expandable member configurable to expand radially away from the second main body; and

a second negative pressure opening provided on the second main body, the second negative pressure opening configurable to apply a negative pressure, wherein the third expandable member is positioned between the second negative pressure opening and a most distal portion of the first end of the second main body; and

a head assembly, the head assembly including:

a first end portion and second end portion opposite to the first end portion of the head assembly, at least a portion of the first end portion of the head assembly housed within and adjacent the first end of the first main body, wherein a length of the head assembly is between about 10-100 mm, wherein the head assembly is configurable to bend in a plurality of directions, wherein the bending of the portion of the head assembly is controllable independently from the bending of the first end of the first main body.

20. The endoscopic system of claim 19, further comprising a pressure control subsystem configurable to provide a negative pressure through the first negative pressure opening.

21. The endoscopic system of claim 19, wherein the expanding of the first expandable member corresponds with the negative pressure applied through the first negative pressure opening.

22. The endoscopic system of claim 19, wherein the head assembly further comprises an image capturing assembly, the image capturing assembly configurable to capture an image.

23. The endoscopic system of claim 19, wherein the head assembly is configurable to provide an instrument at the second end portion of the head assembly, the instrument for use in performing an in vivo procedure in the cavity of the patient.

24. The endoscopic system of claim 19, wherein:
the second anchor assembly further includes:

a fourth expandable member secured to the second main body and provided in such a way that the second negative pressure opening is provided between the third expandable member and the fourth expandable member, the fourth expandable member configurable to expand radially away from the second main body.

25. The endoscopic system of claim 19, further comprising a pressure control subsystem configurable to provide a negative pressure through the second negative pressure opening.

26. An endoscopic system, the endoscopic system comprising:

a first main body, the first main body being an elongated body, the first main body including:

a first end, the first end of the first main body located at a distal end of the first main body;

a plurality of movement control cavities for the first main body, including a first movement control cavity and a second movement control cavity, the first movement

control cavity controllable so as to cause the first end of the first main body to bend in a first direction, the second movement control cavity controllable so as to cause the first end of the first main body to bend in a second direction different from the first direction;

a first anchor assembly at the first end of the first main body, the first anchor assembly including:

a first expandable member secured to the first main body, the first expandable member configurable to expand radially away from the first main body;

a second expandable member secured to the first main body, the second expandable member configurable to expand radially away from the first main body;
and

a first negative pressure opening provided on the first main body between the first expandable member and the second expandable member, the first negative pressure opening configurable to apply a negative pressure;

wherein the first expandable member, the second expandable member, and the first negative pressure opening are configured to cooperate to sufficiently anchor the first main body to an interior wall forming a colonic lumen so as to withstand a force of at least 0.1 N when the first and second expandable members are expanded radially away from the first main body and the first negative pressure opening applies a negative pressure;

a second main body, the second main body being an elongated body having a main cavity, the main cavity housing at least a portion of the first main body and not housing at least a portion of the first end of the first main body, the second main body including:

a first end, the first end of the second main body located at a distal end of the second main body, wherein at least a portion of the first end of the second main body is controllable to bend in a plurality of directions, wherein the bending of the first end of the

second main body is controllable independently from the bending of the first end of the first main body; and

a second anchor assembly at the first end of the second main body, the second anchor assembly including:

a third expandable member secured to the second main body, the third expandable member configurable to expand radially away from the second main body; and

a second negative pressure opening provided on the second main body, the second negative pressure opening configurable to apply a negative pressure, wherein the third expandable member is positioned between the second negative pressure opening and a most distal portion of the first end of the second main body; and

a head assembly, the head assembly being an elongated body, the head assembly including:

a first end, the first end of the head assembly located at a distal end of the head assembly, at least a portion of the first end of the head assembly housed within and adjacent the first end of the first main body, wherein at least a portion of the first end of the head assembly is controllable to bend in a plurality of directions, wherein a length of the head assembly is between about 10-100 mm.

27. The endoscopic system of claim 26, further comprising a pressure control subsystem configurable to provide the negative pressure through the first negative pressure opening.

28. The endoscopic system of claim 26, wherein the expanding of the first expandable member corresponds with the negative pressure applied through the first negative pressure opening.

29. The endoscopic system of claim 26, wherein the head assembly further comprises an image capturing assembly, the image capturing assembly configurable to capture an image.

30. The endoscopic system of claim 26, wherein the head assembly is configurable to provide an instrument at the second end portion of the head assembly, the instrument for use in performing an in vivo procedure in the cavity of the patient.

31. The endoscopic system of claim 26, wherein:
the second anchor assembly further includes:

a fourth expandable member secured to the second main body and provided in such a way that the second negative pressure opening is provided between the third expandable member and the fourth expandable member, the fourth expandable member configurable to expand radially away from the second main body.

32. The endoscopic system of claim 26, further comprising a pressure control subsystem configurable to provide the negative pressure through the second negative pressure opening.