Claims

1. A device for inserting a tube into a body cavity of a patient, the device comprising:

a tube;

a probe; and

a needle configured to enter the body cavity, and to enable entry of the tube and the probe into the body cavity,

wherein the device is configured such that the needle, the tube and the probe distally advance in the body cavity after entry of the probe into the body cavity, with the probe advancing distally beyond the needle.

2. The device of claim 1, wherein the device is configured such that, when the needle is inserted through a region of body tissue prior to entry into the body cavity, the tube and the probe move with the needle.

3. The device of claim 2, wherein the device is configured to apply a biasing force to the probe during insertion of the needle through the region of body tissue, wherein the biasing force causes the probe to advance distally beyond the needle after entry of the probe into the body cavity.

4. The device of any of claims 1 to 3, wherein the device is configured such that the probe advances at a first rate causing distal advancement of the probe relative to the tube after entry of the probe into the body cavity, and subsequently advances at a second rate causing distal advancement of the tube relative to the probe.

5. The device of any of claims 1 to 4, wherein the device is configured such that the tube advances distally relative to the needle after entry of the probe into the body cavity.

6. The device of claim 5, wherein the device is configured such that the tube advances distally beyond the probe after distal advancement of the probe beyond the needle.

7. The device of any of claims 1 to 6, wherein the device is configured to permit retraction of the needle and/or the probe after insertion of the tube into the body cavity.

8. The device of any of claims 1 to 7, wherein the device is configured to retract the needle and/or the probe after insertion of the tube into the body cavity.

9. The device of any of claims 1 to 8, wherein the device is configured to permit decoupling of the tube from the device after insertion of the tube into the body cavity.

10. The device of any of claims 1 to 9, wherein the tube, the probe and the needle are arranged concentrically.

11. The device of any of claims 1 to 10, further comprising a drive mechanism configured to distally advance the needle, the probe and the tube.

12. The device of claim 11, further comprising a support leg configured to abut a body surface of the patient during entry of the needle into the body cavity, wherein the support leg is configured to drive the drive mechanism as the tube advances distally relative to the support leg.

13. The device of claim 11 or claim 12, wherein the drive mechanism comprises a rotatable element coupled to each of the needle, the tube and the probe via a respective mechanical linkage.

14. The device of claim 13, wherein the rate of distal advancement of each of the needle, the tube and the probe is determined by the distance between an end of its respective mechanical linkage that is coupled to the rotatable element and an axle of the rotatable element.

15. The device of any of claims 11 to 14, wherein the drive mechanism is operable to be driven in a first direction to distally advance the needle, the probe and the tube.

16. The device of claim 15, wherein the drive mechanism is operable to be driven in a second direction opposite to the first direction, to retract the probe.

17. The device of claim 16, wherein the drive mechanism is operable to be driven in the second direction to retract the needle.

18. The device of any of claims 1 to 17, further comprising a coupling element configured to couple the tube to the device and to permit decoupling of the tube from the device after insertion of the tube into the body cavity.

19. The device of claim 18, wherein the coupling element is configured to decouple the tube from the device after insertion of the tube into the body cavity.

20. The device of claim 18 or claim 19, wherein the coupling element is configured to cover a tip of the needle after retraction of the needle from the body cavity.

21. A device according to any preceding claim, the device comprising a drive mechanism providing semi-automatic control means and the said mechanism being arranged so that forces within the mechanism balance to maintain the needle, tube, and probe in a stable initial pre-use or storage condition, and, in use, the forces vary to cause the probe to advance relative to the tube on or after entry of the probe into the cavity, and to advance the probe relative to the needle.

22. A device according to claim 21, which includes a datum element (or support leg) for contacting the patient's skin to maintain a spatial relationship between the body of the device and the patient.

23. A device according to the preceding claim in which the datum element is operably connected to the drive mechanism control means.

24. A device according to any one of claim 21- 23 and in which, in use, the drive mechanism receives a force (termed F_{tissue}) through contact of the probe with the skin

and/or tissue of the patient in an initial tissue-engaging condition or as the probe, needle and tube advance through a region of tissue prior to entry into the cavity.

25. A device according to any one of claims 21- 24 in which the control means mechanism is arranged so that forces in the linked elements of the mechanism are balanced during the initial tissue engagement stage by the contact between the probe and the tissue which results in force ("F_{tissue}").

26. A device according to any one of claims 24 to 25 in which the mechanism is arranged so that forces in the linked elements of drive mechanism are unbalanced by a reduction of F_{tissue} during breakthrough of the probe into the cavity.

27. A device according to any one of claims 25 to 26 in which a decrease in the tissue force F_{tissue} on entry of the probe into the cavity, causes the drive mechanism to advance the probe forward relative to the needle.

28. A device according to the preceding claim in which at least one of the balanceable elements of the mechanism comprises a spring, optionally formed from a resilient plastics material element,

29. A device according to any one of claims 21 to 28, in which the mechanism is arranged so that unbalancing of forces in the linked elements of the mechanism initiates movement in linked elements which, in turn, governs the rate of advance of connected components selected from the needle, tube, probe and/or datum (or support leg).

30. A device according to any one of claims 21-29 in which the mechanism includes a control wheel which is operably connected to the probe, tube and needle and controls their relative advancement after their entry into the cavity.

31. A device according to any one of claims 21 to 30, in which the mechanism is arranged so that the needle is retracted as, or once, or after, the tube is moved to a fully deployed condition.

32. A device according to any one of claims 21 to 31 in which mechanism is arranged to move the probe forward relatively quickly in relation to the tube.

33. A device according to any one of claims 21to 32 in which the mechanism is arranged to move the needle backwards in relation to the tube as the probe advances into the cavity.

34. A device according to the preceding claim in which the mechanism is arranged to cause the needle to retract relative to the tube on or after entry of the probe into the cavity.

35. A device according to the preceding claim in which the mechanism is arranged so that a distal tip of the needle as it retracts relative to the tube is shielded by the tube.

36. A device according to any one of claims 21 to 35 in which the mechanism operates such that the probe extends through the cavity faster than the tube after entry of the probe into the cavity.

37. A device according to any one of claims 21 to 36 in which the mechanism is arranged to retract the probe into the device body as or once the tube is moved to a fully deployed condition.

38. A device according to any one of claims 21- 37 in which the mechanism includes at least two force application means for applying force which are mechanically linked and arranged to maintain the probe, needle, and tube in a balanced pre-use condition and to control the advance of the probe relative to the tube on or after contact of the probe with the cavity; and to control advance of the probe relative to the needle.

39. A device according to the preceding claim in which one force application means is sufficiently strong to provide rapid needle retraction as, or once, or after, the tube has moved to a fully deployed condition.

40. A device according to the preceding claim in which another of the force application means is sufficiently strong to control the relative positions of the needle

and/or probe in relation to the tube prior to, and during, contact of the probe with, or entry into, the cavity.

41. A device according any one of claims 38 to 40 in which at least one of the force application means comprises or is constituted by a spring.

42. A device according to the preceding claim in which at least one spring is formed from plastics material.

43. A device according to any preceding claim in which the device is configured so that the needle advances a distance approximately four to six, preferably about five, times the needle diameter into the cavity and then stops, whilst the tube continues to advance through the cavity.

44. A device according to any preceding claim in which, in use, the needle is manually retracted, or manually retractable, by the user.

45. A device according to any one of claims 12 to 44 in which the datum element (or support leg) is formed from a resilient elongate member which optionally provides at least one balanceable element of the drive mechanism.

46. A device according to claim 44 or 45 in which, in use, the device is held by a user in spatial relation to the patient and the drive mechanism is activated by the user after an indication of successful entry of the needle into the cavity, whereby the probe is initially advanced faster than the tube.

47. A device according to any one of claims 7 to 46 in which, in use, the needle is retracted by the mechanism.

48. An intravascular device according to any preceding claim in which the mechanism is arranged so that after entry of the tube and probe into the cavity the tube is subsequently advanced faster than the probe, until the tube is fully or correctly inserted into the cavity.

49. A device according to any one of claims 24 to 48 in which the probe or the probe acting with the needle is sufficiently rigid to transfer the tissue force, F_{tissue}, to the mechanism during tissue engagement.

50. A device according to the preceding claim, in which an exposed portion of the probe extending in use beyond the needle is sufficiently flexible to facilitate movement of the probe in a non-straight cavity.

51. A device according to any preceding claim in which a patient tissue-contacting end of the probe is blunt.

52. A device according to any one of claims 1 to 9 or 11 to 51 in which the probe and needle are arranged side by side.

53. A device according to any one of claims 1 to 9 or 11 to 51 in which the probe is arranged outside the needle.

54. A device according to any one of claims 21 to 53 in which the device body includes a casing and a slider unit movable in relation to the casing.

55. A device according to the preceding claim in which the casing and the slider can be locked to retain the needle when fully retracted within the body.

56. A device according to the preceding claim in which the retracted needle is held in a retracted condition by a clip.

57. A device according to any one of claims 38 to 54 in which the slider unit engages a connection end of the tube by means of a clip.

58. A device according to any one of claims 12 to 57 in which the datum element (or support leg) comprises an elongate flexible member.

59. A device according to any one of claims 12 to 58 in which the datum element (or support leg) comprises a detachable component.

60. A device according to the preceding claim in which the datum component (or support leg) engages the tube in the fully deployed condition of the tube.

61. A device according to the preceding claim in which the engaged datum component (or support leg) forms a wing or other element for fixing the tube to a patient.

62. A device according to any preceding claim in which the relative bluntness of the probe and/or the relative sharpness of the needle are selected to control forces occurring during passage of the needle and probe through the tissue.

63. A device according to any preceding claim in which a piston connected to the probe slides within an associated cylinder and forms a flash chamber.

64. A device according to any one of claims 12 to 63 in which an upstanding element or wing-shaped grip is provided at the distal end of the support leg (or datum) to hold tube stationary while the needle is manually retracted.

65. A device according to any preceding claim in which the cavity is a vein, artery, cranial cavity, vertebrate cavity, thoracic cavity, pericardial cavity, pleural cavity, abdominal cavity or pelvic cavity.

66. A single-handedly operable device according to any preceding claim.

67. An applicator device for inserting a tube into a body cavity of a patient, the device comprising:

a probe; and

a needle configured to enter the body cavity, and to enable entry of the tube and the probe into the body cavity,

wherein the device is configured such that the needle, the tube and the probe distally advance in the body cavity after entry of the probe into the body cavity, with the probe advancing distally beyond the needle.