CLAIMS

1. A puncture instrument comprising:

a puncture tip section;

a first tubular body connected to the puncture tip section at a distal end, and

an outer tubular body at least partially covering the first tubular body, wherein

the first tubular body is formed to be rotatable around an axis along the longitudinal direction,

the first tubular body has an outer diameter smaller than an inner diameter of the outer tubular body, and

a drug solution supply path is provided on the outside of the first tubular body,

wherein the first tubular body is formed such that a drug solution in the drug solution supply path is permeable through an inner portion of the first tubular body.

2. The puncture instrument according to claim 1, wherein the drug solution supply path is formed such that a cross section of a surface perpendicular to the longitudinal direction of the first tubular body is formed to have a circular shape.

3. The puncture instrument according to claim 1 or 2, wherein the drug solution supply path comprises a gap between an inner peripheral surface of the outer tubular body and an outer peripheral surface of the first tubular body.

4. The puncture instrument according to any one of claims 1 to 3, wherein the drug solution supply path is extended to the vicinity of the puncture tip section.

5. The puncture instrument according to any one of claims 1 to 4, wherein the first tubular body is rotatable inside the outer tubular body relative to the outside of the outer tubular body.

6. The puncture instrument according to any one of claims 1 to 5, wherein a second tubular body as a rigid body is connected to a proximal end of the first tubular body.

7. The puncture instrument according to claim 6, wherein

the outer tubular body at least partially covers the second tubular body,

the second tubular body has an outer diameter smaller than an inner diameter of the

outer tubular body and is rotatable inside the outer tubular body together with the first tubular body, and

the drug solution supply path is provided in a gap between the outer peripheral surface of the first tubular body and the inner peripheral surface of the outer tubular body and continues to a gap between the outer peripheral surface of the second tubular body and the inner peripheral surface of the outer tubular body.

8. The puncture instrument according to any one of claims 1 to 7, wherein the first tubular body is formed into a coil shape.

9. The puncture instrument according to claim 8, wherein a direction for winding the coiled first tubular body agrees with a direction for rotating the first tubular body.

10. The puncture instrument according to any one of claims 1 to 9, further comprising:

an aspiration device configured to perform aspiration in an inner space of the first tubular body.

11. The puncture instrument according to claim 10, wherein the aspiration device aspirates a bone marrow fluid, and the drug solution supply path supplies an anticoagulant.

12. The puncture instrument according to any one of claims 1 to 11, wherein

the puncture tip section comprises:

a tube comprising a distal end and an opening in a surface at the distal end,

a tip rotation section configured to perforate a tissue in a medullary cavity while rotating together with the tube, the tip rotation section being disposed on a distal side of the surface at the distal end in the tube, and

a connection member configured to connect the tube and the tip rotation section.

13. The puncture instrument according to claim 12, wherein

the tube comprising the opening is integrally formed with the tip rotation section and the connection member, and

the first tubular body is flexible and is disposed on a proximal side of the tube.

14. The puncture instrument according to claim 12 or 13, wherein the tip rotation section

comprises a disc-shaped member having a radial central axis on a central axis extending in the longitudinal direction of the tube.

15. The puncture instrument according to any one of claims 12 to 14, wherein a groove continuing from the opening of the tube is formed in the connection member.

16. The puncture instrument according to any one of claims 12 to 15, wherein the surface at the distal end is not orthogonal to the longitudinal direction of the tube.

17. The puncture instrument according to any one of claims 12 to 16, wherein
the width of the tip rotation section in a direction orthogonal to the longitudinal direction of the tube is larger than that of the tube in the same.

18. The puncture instrument according to any one of claims 1 to 17, being a bone marrow puncture instrument.

19. A puncture device comprising:
the puncture instrument according to any one of claims 1 to 18; and
a moving rate calculation unit configured to calculate a moving rate of the puncture instrument.

20. The puncture device according to claim 19, comprising: a comparison unit configured to compare the moving rate calculated by the moving rate calculation unit with a predetermined moving rate.

21. The puncture device according to claim 20, comprising: a moving rate notification unit configured to notify the moving rate of the puncture device on the basis of a comparison result obtained by the comparison unit.

22. The puncture device according to any one of claims 19 to 21, comprising:
a position calculation unit configured to calculate a position of the puncture tip section; and
a recording unit configured to record a past trajectory of the puncture tip section.

23. The puncture device according to claim 22, comprising: a display control unit configured to successively display a position of the puncture tip section and the past trajectory recorded by the recording unit.

24. The puncture device according to claim 23, comprising:

a prediction unit configured to predict a trajectory of the puncture tip section, wherein

the display control unit further displays the trajectory of the puncture tip section predicted by the prediction unit.

25. The puncture device according to claim 24, comprising

a notification unit configured to compare the trajectory of the puncture tip section predicted by the prediction unit and the past trajectory recorded by the recording unit and make a notification when the predicted trajectory is substantially the same or the same as the past trajectory.

26. The puncture device according to any one of claims 22 to 25, comprising

a notification unit configured to compare the moving trajectory in which the puncture tip section is moving and the past trajectory recorded by the recording unit and make a notification when the moving trajectory is substantially the same or the same as the past trajectory.

27. A puncture device according to any one of claims 19 to 26, comprising a first magnetic sensor attached to the puncture device.

28. The puncture device according to claim 27, comprising:

a guide tube that guides the puncture device by inserting the puncture instrument according to any one of claims 1 to 18; and

a second magnetic sensor attached to the guide tube.

29. A puncture device comprising:

the puncture instrument according to any one of claims 1 to 18;

a guide tube that guides the puncture instrument; and

a moving rate calculation unit configured to calculate a moving rate of the puncture instrument moving forward through the guide tube.

30. The puncture device according to claim 29, comprising

a comparison unit configured to compare the moving rate calculated by the moving rate calculation unit and a predetermined moving rate associated with an aspiration rate of the bone marrow fluid.

31. A puncture device comprising:

the puncture instrument according to any one of claims 1 to 18;

a guide tube that guides the puncture instrument; and

a position calculation unit configured to calculate a position of the puncture tip section; and

a recording unit configured to record a past trajectory of the puncture tip section.

32. The puncture device according to claim 31, comprising a display control unit configured to successively display a position of the puncture tip section and the past trajectory recorded by the recording unit.

33. The puncture device according to claim 32, comprising

a prediction unit configured to predict a trajectory of the puncture tip section and a contacting position of the puncture tip section with a cortical bone, wherein

the display control unit further displays the trajectory of the puncture tip section and the contacting position predicted by the prediction unit.

34. The puncture device according to claim 32 or 33, wherein

the display control unit displays a past trajectory of the puncture tip section inserted from the same puncture hole into which the puncture instrument has been inserted once.