CATHETER ASSEMBLY

Technical Field

[0001]

The present invention relates to a catheter assembly.

Background Art

[0002]

A patient receives a transfusion by having paracentesis to a blood vessel of the patient with a catheter assembly connected to a transfusion line and indwelling the catheter assembly in the blood vessel.

[0003]

The catheter assembly is configured to include a hollow catheter, a catheter hub fixed onto a base end of the catheter, a needle which is inserted into the catheter and has a sharp needle point at the tip, and a needle hub fixed onto a base end of the needle (for example, see Patent Literature 1). In addition, a valve element (or hemostasis valve) and an operation member (or pusher) performing opening and closing operation of the valve element are accommodated in the catheter hub.

[0004]

The valve element accommodated in the catheter hub has a function of preventing leakage of blood flowing into a passage of the catheter hub via the catheter secured in a blood vessel. Particularly, the catheter assembly of Patent Literature 1 has a valve element including groove portions on an outer periphery surface thereof such that air confined between blood flowing into the passage and the valve element can be released via the groove portions. Accordingly, air bubbles are prevented from remaining in the passage, whereby the inflow of blood reliably takes place.

Citation List

Patent Literature

[0005]

[Patent Literature 1] JP 2002-263197

Summary of Invention

Technical Problems to Be Solved by the Invention

[0006]

In the valve element of the catheter assembly or the catheter assembly of Patent Literature 1, air confined between blood flowing into a passage and the valve element can be released. However, it has also happened that blood which has flowed into the passage via the groove portions has infiltrated a base end side of the valve element.

[0007]

The blood infiltrating the base end side of the valve element from the groove portions remains between the valve element and an operation member even after administration of a liquid medicine performed by connecting an infusion set or a syringe thereto is completed. Such blood may result in a possible proliferation source of bacteria or a thrombus formation.

[0008]

The present invention has been made taking the above-mentioned circumstances into consideration. Therefore, an object of the present invention is to provide a catheter assembly which prevents blood from infiltrating between a valve element and an operation member when performing a blood vessel paracentesis.

Means for Solving the Problems

[0009]

According to the present invention to solve the above-mentioned problems, there is provided a catheter assembly including: a hollow catheter; a catheter hub, fixed onto a base end portion of the catheter, internally having a passage communicating with the inside of the catheter; a needle inserted into the catheter; and a needle hub, fixed onto a base end portion of the needle, capable of being connected to a base end side of the catheter hub. Further, the catheter assembly includes: a valve element, positioned to block the passage, having an opening and closing unit capable of being opened and closed; an operation member having a tubular body, arranged such that the base end side of the catheter hub communicates with a tip side thereof via inserting one opening portion of the operation member into the opening and closing unit; and a communication unit, provided on an inner periphery portion of the catheter hub including the valve element or a periphery edge portion of the valve element such that the base end side of the catheter hub communicates with the tip side thereof .

Moreover, in the catheter assembly, a sealing member (liquid impermeable) having a tubular body and allowing the passage of air yet prohibiting the passage of liquid is provided between the valve element and the operation member so as to block the communication unit,.

[0010]

Since the catheter assembly according to the present invention is provided with the sealing member between the valve element and the operation member, even in a case where liquid such as blood flows over the valve element and reaches the base end side, it is possible to prohibit the liquid from infiltrating between the sealing member and the operation member. That is, the liquid can be prohibited from infiltrating

the base end side of the sealing member arranged to tightly contact the valve element.

[0011]

In the present invention, it is preferable that the sealing member be a porous body.

The porous body can allow the passage of air yet does not allow the passage of liquid. Accordingly, if the aforementioned sealing member is employed, even in a case where liquid such as blood reaches the base end side of the valve element, it is possible to prohibit blood from infiltrating between the sealing member and the operation member.

[0012]

In the present invention, it is preferable that the sealing member have a tubular molded article including at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article. Further, it is preferable that the other end surface of the molded article be provided with a hydrophobic filter. In addition, preferably, at least a part of the hole portion and the outer periphery groove portion may be coated with a water-swelling polymer.

[0013]

The hydrophobic filter allows the passage of air yet blocks the passage of liquid. Accordingly, if the hydrophobic filter is provided on the other end surface of the sealing member, even in a case where liquid such as blood reaches the base end side of the valve element through at least one of the hole portion and the outer periphery groove portion, it is possible to prevent blood from infiltrating the base end side via flowing over the hydrophobic filter provided on the sealing member.

In addition, as described below, since the water-swelling polymer absorbs liquid such as water or blood so as to swell, it is possible to more reliably prevent blood from infiltrating the base end side via flowing over the hydrophobic filter provided on the sealing member.

[0014]

In the present invention, it is preferable that the sealing member have the tubular molded article including at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface, and an outer periphery groove portion formed on the outer periphery surface of the molded article. Herein, preferably at least a part of the inside of the hole portion and the inside of the outer periphery groove portion may be coated with a water-swelling polymer.

[0015]

The water-swelling polymer absorbs liquid such as water or blood so as to swell. Accordingly, if at least a part of the hole portion and the outer periphery groove portion formed on the sealing member is coated with the water-swelling polymer, it is possible to allow the passage of air through the hole portion or the outer periphery groove portion. Then, in a case where liquid such as blood infiltrates the base end side via flowing over the valve element, the water-swelling polymer swells by contacting the liquid, whereby the hole portion or the outer periphery groove portion is blocked by the swelled polymer. Accordingly, it is possible to prevent liquid such as blood from infiltrating between the sealing member and the operation member.

Advantageous Effects of the Invention

[0016]

According to the present invention, it is possible to provide a catheter assembly which prevents blood from infiltrating between a sealing member arranged to tightly contact a valve element and an operation member.

Brief Description of Drawings

[0017]

Fig. 1 is an exploded perspective view of a catheter assembly according to an embodiment.

Fig. 2 is a longitudinal sectional view of the catheter assembly according to the embodiment.

Fig. 3 is a longitudinal sectional view of the catheter assembly according to the embodiment in which a paracentesis needle is evulsed.

Fig. 4 is a longitudinal sectional view of the catheter assembly to which a connector is connected according to the embodiment.

Fig. 5 is a cross-sectional view of an indwelling catheter taken along the line A-A of Fig. 3, and is a view illustrating a state where eight communication units are provided.

Figs. 6A and 6B are views each illustrating another embodiment of a sealing member. Fig. 6A is a perspective view, and Fig. 6B is a cross-sectional view taken along the line B-B of Fig. 6A.

Fig. 7 is a perspective view illustrating still another embodiment of the sealing member.

Embodiments for Carrying Out the Invention

[0018]

Hereinafter, an embodiment of a catheter assembly according to the present invention will be described in detail referring to the appropriate views. Moreover, hereinafter,

for convenience of description, the right side in Figs. 1 to 4 denotes a "base end", and the left side therein denotes a "tip". Further, the "tip" denotes a blood vessel paracentesis side.
[0019]

As illustrated in Fig. 1, a catheter assembly 1 according to the embodiment is configured to have an indwelling catheter 11 and a paracentesis needle 12. A protector P is attached to the catheter assembly 1 for protecting the indwelling catheter 11.
[0020]

The catheter assembly 1 having the above-mentioned configuration may be in an assembled state (state illustrated in Figs. 1 and 2) where the indwelling catheter 11 and the paracentesis needle 12 are assembled, or an evulsed state (state illustrated in Fig. 3) where the paracentesis needle 12 is evulsed from the indwelling catheter 11. The catheter assembly 1 can be used for the paracentesis into a surface of a living body in the assembled state. Thereafter, the indwelling catheter 11 can be indwelled on the surface of a living body after switching into the evulsed state. Herein, it is possible to connect a connector 20 to the indwelling catheter 11 indwelled on the surface of a living body (see Fig. 4).
[0021]

Here, before describing the catheter assembly 1, the connector 20 will be described referring to Fig. 4.

As illustrated in Fig. 4, the connector 20 has a tubular body and is connected to a base end portion of the indwelling catheter 11. A tip portion of a tube (not illustrated) is connected to the base end portion of the connector 20. Then, a bag (not illustrated) filled with an infusion solution Q is connected to a base end portion of the tube. The infusion solution Q is supplied from the bag in a connected state where

the connector 20 is connected to the indwelling catheter 11 (see Fig. 4).

Further, in order to reliably supply the infusion solution Q, it is preferable that the connector 20 have a locking mechanism (not illustrated) which is engaged with a locking unit 32 provided on an outer periphery of the base end portion of the indwelling catheter 11 so as to be fixed in the indwelling catheter 11.

[0022]

In addition, a tip portion of the connector 20 connected to the base end portion of the indwelling catheter 11 may have a tapered shape in which the outer diameter thereof is gradually decreased toward the tip. Accordingly, when connecting the connector 20, it is possible to easily insert the connector 20 into the base end portion of the indwelling catheter 11. In addition, after the infusion solution Q is supplied, the connector 20 can be easily removed from the base end portion of the indwelling catheter 11. That is, it is possible to easily perform insertion and evulsion operations of the connector 20 with respect to the indwelling catheter 11.

[0023]

Returning to Fig. 1, the description of the catheter assembly 1 according to the embodiment will be continued.

The indwelling catheter 11 is configured to mainly include a hollow catheter 2 and a catheter hub 3, fixed onto a base end portion of the catheter 2, internally having a passage 31 which communicates with the inside of the catheter 2. In addition, in order to facilitate the manual operation for inserting the catheter 2 toward a blood vessel, it is preferable that the catheter hub 3 have a tab 36 protruding from an outer periphery surface thereof.

[0024]

It is preferable that the catheter 2 be a tube that is flexible to some extent. A resin material, particularly, a soft resin material is suitable for the catheter 2 as a component material. Specifically, for example, a fluorine-based resin such as polytetrafluoroethylene (PTFE), ethylene-tetrafluoroethylene copolymer (ETFE) and perfluoroalkoxy fluorine resin (PFA); olefin-based resin such as polyethylene and polypropylene or a mixture thereof; polyurethane; polyester; polyamide; polyether nylon resin; or a mixture of the olefin-based resin and ethylene-vinyl acetate copolymer can be exemplified.

[0025]

It is preferable that the inside of the catheter 2 have visibility to be visually perceivable in its entirety or in a part thereof. That is, it is preferable that the catheter 2 be constituted by a resin which is transparent (colorless transparent), colored transparent or semi-transparent. Accordingly, when the catheter 2 is secured in a blood vessel, it is possible to visually check a phenomenon in which blood R (see Fig. 4) flows into the transparent catheter hub 3 through an intracavity 21 of the catheter 2 (that is, a flashback of blood).

[0026]

In addition, it is also possible to mix an X-ray contrast agent such as barium sulfate, barium carbonate, bismuth carbonate or tungstic acid in the component material of the catheter 2 to impart a contrast imaging function.

[0027]

For example, the base end portion of the catheter 2 is liquid-tightly fixed onto the catheter hub 3 by caulking, fusing (heat fusing, high-frequency fusing or the like) or bonding using a bonding agent. Further, Figs. 2 and 3 illustrate a state

where the catheter 2 and the catheter hub 3 are fixed to each other by a caulking pin 33. The caulking pin 33 has a circular tube portion at the tip side and a tapered portion gradually increased in diameter from the circular tube portion toward the base end side. In other words, the caulking pin 33 is gradually decreased in diameter from the base end side toward the tip side. Therefore, if the infusion solution Q flows in from the base end side, this allows the infusion solution Q to smoothly flow out toward the catheter 2. Since the catheter 2 and the catheter hub 3 are caulked at the circular tube portion, it is preferable that the caulking pin 33 be made of metal or hard resin.

In a case where the catheter 2 and the catheter hub 3 are fixed to each other by the fusing or the bonding agent, it is possible not to employ the caulking pin 33 (not illustrated). Alternatively, in this case, in place of the above-described tapered portion, the passage 31 of the tip portion may be formed in a tapered portion such that the inner diameter thereof is gradually decreased in the tip direction. Accordingly, this tapered portion enables the infusion solution Q to smoothly flow out toward the catheter 2 when the infusion solution Q flows in from the base end side.

[0028]

As illustrated in Fig. 2, the catheter hub 3 is constituted by a member having a tubular body such that an intracavity portion thereof functions as the passage 31. The passage 31 communicates with the intracavity 21 of the catheter 2.

[0029]

It is preferable that the base end portion of the passage 31 of the catheter hub 3 have a tapered shape in which the inner diameter of a wall portion 311 thereof is gradually increased toward the base end direction. It is further preferable that the tapering of the base end portion of the passage 31 of the

catheter hub 3 and the tapering of the tip of the connector 20 be formed in mutually corresponding shape (or similarity in tapering angle). Accordingly, it is possible to easily insert the tip of the tapered connector 20 into the corresponding base end portion of the tapered catheter hub 3 to be connected thereto. In addition, in this connecting manner, the wall portion 311 of the passage 31 tightly contacts the outer periphery portion of the connector 20, thereby maintaining a further liquid-tight state.

[0030]

In addition, in the middle of the passage 31, it is preferable that a step difference portion 35 having a tip side reduced in diameter with respect to the base end side be formed. If an end surface of the tip side of the valve element 7 to be described below is provided to abut on the step difference portion 35, the valve element 7 can be stably fixed thereto.

[0031]

In addition, in the embodiment, as illustrated in Figs. 1 to 4, the valve element 7 is provided so as to block the passage 31. Specifically, as illustrated in Fig. 3, the valve element 7 having a bottomed tubular shape is fixed such that the outer periphery surface of the side wall of the valve element 7 contacts the inner periphery surface of the catheter hub 3. An opening and closing unit 71 (see Fig. 4) capable of being opened and closed is provided at the bottom portion of the valve element 7. The valve element 7 is configured to have a valve mechanism 6 including the opening and closing unit 71, and an operation member 8 to be described below.

[0032]

The opening and closing unit 71 is configured to include a slit 711 (see Figs. 3 and 5) passing through in the thickness direction, to be formed at the center part of the bottom portion.

The shape of the slit 711 may be formed without any particular limitation as long as the operation member 8 can be inserted into the slit and removed therefrom. For example, the bottom portion in a plan view can be formed in a shape of straight line, cross, letter Y (or modified letter Y). Accordingly, the opening and closing unit 71 not only allows the operation member 8 to be inserted into and removed from the slit 711, but also becomes reliably self-occlusive.

[0033]

It is preferable that the valve element 7 be composed of an elastic material having a tightness which is not easily opened by a blood flow. If the valve element 7 is composed of the elastic material, it is possible to smoothly open and close the opening and closing unit 71. As the elastic material composing the valve element 7, for example, various rubber materials such as natural rubber, isoprene rubber, isobutylene-isoprene rubber, butadiene rubber, styrene-butadiene rubber, urethane rubber, nitrile rubber, acrylic rubber, fluororubber, and silicone rubber (particularly, vulcanized rubber); various thermoplastic elastomers such as urethane-based, polyester-based, polyamide-based, olefin-based, and styrene-based thermoplastic elastomers; or various elastic materials made as a mixture of aforementioned materials can be exemplified. Among the elastic materials, particularly, it is preferable that isoprene rubber be employed. If isoprene rubber is employed as the component material of the valve element 7, this allows the valve element 7 to have such advantages as a low permanent compression set and a long duration period thereof.

[0034]

The operation member 8 having a tubular body is arranged such that when one (at the tip side) opening portion 85 thereof

(see Fig. 4) is inserted into the opening and closing unit 71 of the valve element 7, the base end side of the catheter hub 3 communicates with the tip side thereof through the operation member 8. Accordingly, due to the valve mechanism 6, the movement of the operation member 8 along the axial direction of the passage 31 enables the one opening portion 85 to be inserted into and removed from the opening and closing unit 71 of the valve element 7, thereby performing the shut-off (see Fig. 3) and opening (see Fig. 4) of the passage 31.

[0035]

Since in the valve mechanism 6 illustrated in Fig. 3, the entire operation member 8 is positioned closer to the base end side than the opening and closing unit 71, the opening and closing unit 71 is closed due to the self-occlusive property, thereby shutting off the passage 31. On the other hand, in the valve mechanism 6 illustrated in Fig. 4, the opening portion 85 at the tip side of the operation member 8 is positioned at the tip side via passing through the opening and closing unit 71. Therefore, the passage 31 is opened via the intracavity of the operation member 8.

[0036]

As illustrated in Fig. 4, on the tip outer periphery portion of the operation member 8, there are formed two tip diameter expanded portions 81a and 81b of which outer diameters are expanded, that is, protruding along the peripheral direction. The tip diameter expanded portion 81b among the tip diameter expanded portions 81a and 81b functions as an engagement portion engaging with the opening and closing unit 71 of the valve element 7 when the passage 31 is opened after the operation member 8 has passed through the opening and closing unit 71. This engagement of the tip diameter expanded portion 81b with the opening and closing unit 71 of the valve

element 7 prevents the operation member 8 from accidentally moving toward the base end direction, thereby reliably maintaining the open state of the passage 31.

[0037]

In addition, it is preferable that the tip diameter expanded portions 81a and 81b be respectively in a tapered shape. Accordingly, when the operation member 8 passes through the opening and closing unit 71 of the valve element 7, the tip diameter expanded portions 81a and 81b are capable of reliably pushing and outwardly widening the opening and closing unit 71 in sequence thereof, thereby facilitating the operation member 8 to easily pass through. Then, the parts of the operation member 8 (that is, tip diameter expanded portions 81a and 81b) passed through the opening and closing unit 71 are protruded from the opening and closing unit 71.

[0038]

As described above, the operation member 8 is configured to be in a tubular body. Therefore, when the operation member 8 is moved, the outer periphery portion of the operation member 8, for example, a base end diameter expanded portion 84 (see Fig. 4) slides on the wall portion 311 of the passage 31. Accordingly, the movement of the operation member 8 is stably performed.

[0039]

As illustrated in Fig. 4, it is preferable that the inner diameter of the base end diameter expanded portion 84 be the same as or larger than the inner diameter of the connector 20.

Accordingly, when the connector 20 is connected to the base end portion of the catheter hub 3, it is possible to easily and reliably cause the infusion solution Q to flow from the connector 20 to the operation member 8.

[0040]

In the embodiment, a communication unit 9 (see Figs. 2 to 5) is provided on the inner periphery portion of the catheter hub 3 having the valve element 7, or on the periphery edge portion of the valve element 7, such that the base end side of the catheter hub 3 communicates with the tip side thereof.

[0041]

Specifically, as illustrated in Fig. 5, in the middle of the passage 31 of the catheter hub 3, there is formed one or more inner periphery groove portions 9a along the catheter hub 3 in the axial direction from the above-mentioned step difference portion 35 as the communication unit 9.

[0042]

The inner periphery groove portion 9a is provided to prevent air from remaining inside the catheter hub 3, when the needle 4 is evulsed after the paracentesis is performed into a surface of a living body with the catheter 2 and the needle 4. That is, when the needle 4 is evulsed, air closer to the tip side than the valve element 7 is pushed by the flow of the blood R getting into the passage 31 to pass through the inner periphery groove portion 9a, thereby being discharged to the base end side. Further, the shape of the inner periphery groove portion 9a is not particularly limited in shape as long as the inner periphery groove portion 9a can exhibit the above-mentioned function. For example, the shape of the inner periphery groove portion 9a may be formed in a linear fashion on the inner periphery surface of the catheter 2 from the tip side to the base end side, in a corrugated fashion, or in a spiral fashion. In addition, the depth of the inner periphery groove portion 9a is not particularly limited as long as the above-mentioned function can be exhibited. For example, the depth thereof can be set to approximately 5 μm to 20 μm.

[0043]

In the present invention, a sealing member 10 is provided at a space between the valve element 7 and the operation member 8, that is, at the base end side of the valve element 7 so as to block the communication unit 9. The sealing member 10 having a tubular body is sealable, allowing the passage of air yet prohibiting the passage of liquid. Here, the sealing member 10 is arranged to tightly contact the valve element 7 so as to block the inner periphery groove portion 9a. It is preferable that the sealing member 10 be faucet-jointed to the valve element 7 for improving the tightly contacting state. The sealing member 10 can be fixed onto the inner periphery surface of the catheter hub 3 by fusing or a bonding agent. In the valve element 7, displacement of the base end side is suppressed by the sealing member 10 and displacement of the tip side is suppressed by the step difference portion 35. Accordingly, fluctuations of the position are suppressed regardless of the insertion and removal of the operation member 8, and thus it is possible to smoothly perform the opening and closing operation of the valve element 7.

Further, if the communication unit 9 is provided with the periphery edge portion of the valve element 7, the communication unit 9 may be either a through hole passing through the periphery edge portion of the valve element 7, or an outer periphery groove provided on the outer periphery surface of the valve element 7.

[0044]

The employed sealing member 10 is to allow the passage of air yet does not allow the passage of liquid. As the sealing member 10, for example, it is possible to preferably employ a sealing member formed in a porous body such as a sintered body made of polyethylene. The sealing member 10 made of a porous body is easy to be manufactured, thereby having an advantage

in which the sealing member 10 can be precisely manufactured.

[0045]

Here, as another embodiment of the sealing member 10, a sealing member 10′ illustrated in Figs. 6A and 6B can be exemplified. The sealing member 10′ having a molded article 10a made of a resin material and molded in a tubular body including at least one of a hole portion 10b passing through from one end surface 10a1 of the molded article 10a tightly contacting the valve element 7 to the other end surface 10a2 and an outer periphery groove portion (not illustrated in Figs. 6A and 6B) formed on the outer periphery surface, while disposing a hydrophobic filter 10c on the other end surface 10a2. It is also possible to coat at least a part of the hole portion 10b and the outer periphery groove portion of the sealing member 10′ with a water-swelling polymer. As the water-swelling polymer to coat with, a water-swelling polymer which is the same as a water-swelling polymer 10e to be described below can be employed.

[0046]

As the hydrophobic filter 10c, for example, a monolayer sheet or a multilayer sheet made of an olefin resin such as polyethylene or polypropylene, having the thickness of 0.03 mm to 0.3 mm can be employed.

[0047]

As further another embodiment of the sealing member 10, a sealing member 10″ illustrated in Fig. 7 can be exemplified. The sealing member 10″ having the molded article 10a made of a resin material and molded in a tubular body, includes at least one of a hole portion (not illustrated in Fig. 7) passing through from one end surface 10a1 in which the molded article 10a tightly contacts the valve element 7 to the other end surface 10a2 and an outer periphery groove portion 10d formed on the outer

periphery surface. At least a part of the inside of the hole portion and the inside of the outer periphery groove portion 10d is coated with the water-swelling polymer 10e.

[0048]

As the water-swelling polymer 10e, for example, polyvinyl-pyrrolidone; methyl vinyl ether-maleic anhydride copolymer; an acrylamide-acrylate copolymer such as a dimethylacrylamide-glycidyl methacrylate copolymer; a water-soluble synthetic polymer such as sodium polyacrylate, polyacrylamide, polystyrene sulfonate, polyvinyl alcohol, polyethylene oxide and polyethylenimine; a water-soluble semi-rigid polymer such as carboxymethyl starch, dialdehyde starch, carboxymethyl cellulose and hydroxyethyl cellulose; a water-soluble natural polymer such as tannin, lignin, alginic acid, gum Arabic, guar gum, gum tragacanth, gelatin, casein and collagen can be exemplified.

[0049]

As the molded article 10a, for example, various resin materials such as: polyethylene, polypropylene, polyolefin such as ethylene-vinyl acetate copolymer, polyurethane, polyamide, polyester, polycarbonate, polybutadiene, and polyvinyl chloride can be employed.

[0050]

As illustrated in Figs. 1 and 2, a paracentesis needle 12 is configured to include a needle 4 and a needle hub 5.

As illustrated in Fig. 2, the base end portion of the needle 4 is fixed onto the needle hub 5. In an assembled state, the catheter assembly 1 is configured by inserting the needle 4 into the catheter 2, the valve element 7 and the operation member 8 such that a sharp needle point 41 of the needle 4 protrudes from the tip opening portion 22 of the catheter 2. Then, the needle point 41 is used for the paracentesis into a

surface of a living body. In addition, in the assembled state, the tip of the needle hub 5 is inserted into the base end portion of the catheter hub 3 to be fitted thereto.

[0051]

A groove (not illustrated) may be provided at the outer periphery portion of the needle 4 along the axial direction of the needle 4. The groove functions as an introduction passage introducing the blood R into the intracavity 21 of the catheter 2 when the blood vessel paracentesis is performed. The blood R introduced from the groove flows into a gap between the needle 4 and the catheter 2. Accordingly, it is possible to reliably check the flashback of the blood R from an early stage. Then, the blood R passes through the intracavity 21 of the catheter 2 to flow into the passage 31 of the catheter hub 3.

[0052]

For example, as a component material of the needle 4, a metal material such as stainless steel, aluminum or aluminum alloy, titanium or titanium alloy can be exemplified.

[0053]

The needle hub 5 fixed (or adhered) to the base end portion of the needle 4, having a tubular shape, includes an air filter (not illustrated) to be disposed at the base end opening portion of the needle hub 5.

[0054]

It is preferable that the catheter hub 3, the operation member 8 and the needle hub 5 described above be configured of a resin which is transparent (colorless transparent), colored transparent or semi-transparent, thereby securing visibility of the inside thereof. Accordingly, when the catheter 2 is secured in the blood vessel, the flashback of the blood R can be visually checked.

[0055]

For example, as a component material of the catheter hub 3, the operation member 8 and the needle hub 5, various resin materials such as polyolefin like polyethylene, polypropylene and ethylene-vinyl acetate copolymer, polyurethane, polyamide, polyester, polycarbonate, polybutadiene and polyvinyl chloride can be exemplified.

[0056]

The above-described catheter assembly 1 according to the embodiment is used as follows.

First, a protector P is removed from the catheter assembly 1 in a state where the needle 4 is inserted into the catheter 2. Next, the catheter hub 3 is grasped to perform the blood vessel paracentesis to a patient with the needle 4. If the catheter 2 is secured in the blood vessel , the blood R flows to the base end direction through the space between the catheter 2 and the needle 4 based on the blood pressure. Since the catheter 2 or the catheter hub 3 is formed of a material which is colorless transparent, colored transparent or semi-transparent, flow of the blood R is visually perceivable. The flow of the blood R reaches a place where the valve element 7 of the passage 31 is positioned. At this time, air confined between the blood R and the valve element 7 is discharged to the base end side of the sealing member 10 (or 10′, 10″) via the sealing member 10 (or 10′, 10″) passing through the communication unit 9 (that is, inner periphery groove portion 9a). After the flow of the blood R is visually perceived, the catheter assembly 1 is further advanced for a very small distance toward the tip direction. Specifically, the catheter 2 is advanced forward to a predetermined position inside the blood vessel by holding the tab 36 formed on the outer periphery surface of the catheter hub 3 with fingers.

[0057]

After the catheter 2 is secured in the blood vessel, the catheter 2 or the catheter hub 3 is held by one hand, while the needle hub 5 is grasped by the other hand to be pulled toward the base end direction. Then, the needle 4 is evulsed from the catheter 2 (see Figs. 2 and 3). Accordingly, the catheter assembly 1 is turned into a disassembled state. At this time, since the opening and closing unit 71 of the valve element 7 is in a closed state in the indwelling catheter 11, the blood R inside the passage 31 is prevented from leaking out to the outside. In addition, since the above-mentioned sealing member 10 tightly contacting the valve element 7 is provided inside the catheter hub 3, it is possible to prevent the blood R from leaking out from the inside of the catheter hub 3 when the needle 4 is evulsed. Further, the evulsed paracentesis needle 12 is no longer necessary, thereby being discarded.
[0058]

Next, the catheter hub 3 of the indwelling catheter 11 is fixed onto the skin using an adhesive tape or the like. Then, the connector 20 is connected to the catheter hub 3 (see Fig. 4). This connection allows the operation member 8 to be pressed by the connector 20, thereby to be moved in the tip direction such that the opening portion 85 at one side of the operation member 8 passes through the valve element 7. Accordingly, the passage 31 is turned into an open state.
[0059]

Next, supply of the infusion solution Q is started. In this manner, the infusion solution Q, sequentially passing through the inside of the connector 20 and the inside of the operation member 8, flows out from the opening portion 85 at one side of the operation member 8, thereby filling the entire passage 31 with the infusion solution Q (that is, priming completed) (see Fig. 4).

Reference Signs List

[0060]

1 catheter assembly
11 indwelling catheter
12 paracentesis needle
2 catheter
21 intracavity
22 tip opening portion
3 catheter hub
31 passage
311 wall portion
32 locking unit
33 caulking pin
35 step difference portion
36 tab
4 needle
41 needle point
5 needle hub
6 valve mechanism
7 valve element
71 opening and closing unit
711 slit
8 operation member
81a, 81b tip expanded diameter portion
84 base end expanded diameter portion
85 opening portion
9 communication unit
9a inner periphery groove portion
10 sealing member
10a1, 10a2 end surface
10a molded article

10b hole portion

10c hydrophobic filter

10d outer periphery groove portion

10e water-swelling polymer

20 connector

P protector

CLAIMS

[Claim 1]

A catheter assembly comprising:

a hollow catheter;

a catheter hub, fixed onto a base end portion of the catheter, internally having a passage communicating with an internal portion of the catheter;

a needle inserted into the catheter;

a needle hub, fixed onto a base end portion of the needle, capable of being connected to a base end side of the catheter hub;

a valve element, positioned to block the passage, and having an opening and closing unit capable of being opened and closed;

an operation member having a tubular body, arranged such that the base end side of the catheter hub communicates with a tip side thereof when one opening portion of the operation member is inserted into the opening and closing unit; and

a communication unit, provided with an inner periphery portion of the catheter hub including the valve element or a peripheral edge portion of the valve element such that the base end side of the catheter hub communicates with the tip side thereof, wherein a sealing member having a tubular body and allowing the passage of air yet prohibiting the passage of liquid, is provided between the valve element and the operation member so as to block the communication unit.

[Claim 2]

The catheter assembly according to Claim 1, wherein the sealing member is a porous body.

[Claim 3]

The catheter assembly according to Claim 1, wherein

the sealing member has a tubular molded article,

the molded article includes at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article, and

the other end surface of the molded article is provided with a hydrophobic filter.

[Claim 4]

The catheter assembly according to Claim 3, wherein

at least a part of the hole portion and the outer periphery groove portion is coated with a water-swelling polymer.

[Claim 5]

The catheter assembly according to Claim 1, wherein

the sealing member has a tubular molded article,

the molded article includes at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article, and

at least a part of an internal portion of the hole portion and an internal portion of the outer periphery groove portion is coated with a water-swelling polymer.

CATHETER ASSEMBLY

Technical Field

[0001]

The present invention relates to a catheter assembly.

Background Art

[0002]

A patient receives a transfusion by having paracentesis to a blood vessel of the patient with a catheter assembly connected to a transfusion line and indwelling the catheter assembly in the blood vessel.

[0003]

The catheter assembly is configured to include a hollow catheter, a catheter hub fixed onto a base end of the catheter, a needle which is inserted into the catheter and has a sharp needle point at the tip, and a needle hub fixed onto a base end of the needle (for example, see Patent Literature 1). In addition, a valve element (or hemostasis valve) and an operation member (or pusher) performing opening and closing operation of the valve element are accommodated in the catheter hub.

[0004]

The valve element accommodated in the catheter hub has a function of preventing leakage of blood flowing into a passage of the catheter hub via the catheter secured in a blood vessel. Particularly, the catheter assembly of Patent Literature 1 has a valve element including groove portions on an outer periphery surface thereof such that air confined between blood flowing into the passage and the valve element can be released via the groove portions. Accordingly, air bubbles are prevented from remaining in the passage, whereby the inflow of blood reliably takes place.

Citation List

Patent Literature

[0005]

[Patent Literature 1] JP 2002-263197

Summary of Invention

Technical Problems to Be Solved by the Invention

[0006]

In the valve element of the catheter assembly or the catheter assembly of Patent Literature 1, air confined between blood flowing into a passage and the valve element can be released. However, it has also happened that blood which has flowed into the passage via the groove portions has infiltrated a base end side of the valve element.

[0007]

The blood infiltrating the base end side of the valve element from the groove portions remains between the valve element and an operation member even after administration of a liquid medicine performed by connecting an infusion set or a syringe thereto is completed. Such blood may result in a possible proliferation source of bacteria or a thrombus formation.

[0008]

The present invention has been made taking the above-mentioned circumstances into consideration. Therefore, an object of the present invention is to provide a catheter assembly which prevents blood from infiltrating between a valve element and an operation member when performing a blood vessel paracentesis.

Means for Solving the Problems

[0009]

According to the present invention to solve the above-mentioned problems, there is provided a catheter assembly including: a hollow catheter; a catheter hub, fixed onto a base end portion of the catheter, internally having a passage communicating with the inside of the catheter; a needle inserted into the catheter; and a needle hub, fixed onto a base end portion of the needle, capable of being connected to a base end side of the catheter hub. Further, the catheter assembly includes: a valve element, positioned to block the passage, having an opening and closing unit capable of being opened and closed; an operation member having a tubular body, arranged such that the base end side of the catheter hub communicates with a tip side thereof via inserting one opening portion of the operation member into the opening and closing unit; and a communication unit, provided on an inner periphery portion of the catheter hub including the valve element or a periphery edge portion of the valve element such that the base end side of the catheter hub communicates with the tip side thereof .

Moreover, in the catheter assembly, a sealing member (liquid impermeable) having a tubular body and allowing the passage of air yet prohibiting the passage of liquid is provided between the valve element and the operation member so as to block the communication unit,.

[0010]

Since the catheter assembly according to the present invention is provided with the sealing member between the valve element and the operation member, even in a case where liquid such as blood flows over the valve element and reaches the base end side, it is possible to prohibit the liquid from infiltrating between the sealing member and the operation member. That is, the liquid can be prohibited from infiltrating

the base end side of the sealing member arranged to tightly contact the valve element.

[0011]

In the present invention, it is preferable that the sealing member be a porous body.

The porous body can allow the passage of air yet does not allow the passage of liquid. Accordingly, if the aforementioned sealing member is employed, even in a case where liquid such as blood reaches the base end side of the valve element, it is possible to prohibit blood from infiltrating between the sealing member and the operation member.

[0012]

In the present invention, it is preferable that the sealing member have a tubular molded article including at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article. Further, it is preferable that the other end surface of the molded article be provided with a hydrophobic filter. In addition, preferably, at least a part of the hole portion and the outer periphery groove portion may be coated with a water-swelling polymer.

[0013]

The hydrophobic filter allows the passage of air yet blocks the passage of liquid. Accordingly, if the hydrophobic filter is provided on the other end surface of the sealing member, even in a case where liquid such as blood reaches the base end side of the valve element through at least one of the hole portion and the outer periphery groove portion, it is possible to prevent blood from infiltrating the base end side via flowing over the hydrophobic filter provided on the sealing member.

In addition, as described below, since the water-swelling polymer absorbs liquid such as water or blood so as to swell, it is possible to more reliably prevent blood from infiltrating the base end side via flowing over the hydrophobic filter provided on the sealing member.

[0014]

In the present invention, it is preferable that the sealing member have the tubular molded article including at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface, and an outer periphery groove portion formed on the outer periphery surface of the molded article. Herein, preferably at least a part of the inside of the hole portion and the inside of the outer periphery groove portion may be coated with a water-swelling polymer.

[0015]

The water-swelling polymer absorbs liquid such as water or blood so as to swell. Accordingly, if at least a part of the hole portion and the outer periphery groove portion formed on the sealing member is coated with the water-swelling polymer, it is possible to allow the passage of air through the hole portion or the outer periphery groove portion. Then, in a case where liquid such as blood infiltrates the base end side via flowing over the valve element, the water-swelling polymer swells by contacting the liquid, whereby the hole portion or the outer periphery groove portion is blocked by the swelled polymer. Accordingly, it is possible to prevent liquid such as blood from infiltrating between the sealing member and the operation member.

Advantageous Effects of the Invention

[0016]

According to the present invention, it is possible to provide a catheter assembly which prevents blood from infiltrating between a sealing member arranged to tightly contact a valve element and an operation member.

Brief Description of Drawings

[0017]

Fig. 1 is an exploded perspective view of a catheter assembly according to an embodiment.

Fig. 2 is a longitudinal sectional view of the catheter assembly according to the embodiment.

Fig. 3 is a longitudinal sectional view of the catheter assembly according to the embodiment in which a paracentesis needle is evulsed.

Fig. 4 is a longitudinal sectional view of the catheter assembly to which a connector is connected according to the embodiment.

Fig. 5 is a cross-sectional view of an indwelling catheter taken along the line A-A of Fig. 3, and is a view illustrating a state where eight communication units are provided.

Figs. 6A and 6B are views each illustrating another embodiment of a sealing member. Fig. 6A is a perspective view, and Fig. 6B is a cross-sectional view taken along the line B-B of Fig. 6A.

Fig. 7 is a perspective view illustrating still another embodiment of the sealing member.

Embodiments for Carrying Out the Invention

[0018]

Hereinafter, an embodiment of a catheter assembly according to the present invention will be described in detail referring to the appropriate views. Moreover, hereinafter,

for convenience of description, the right side in Figs. 1 to 4 denotes a "base end", and the left side therein denotes a "tip". Further, the "tip" denotes a blood vessel paracentesis side.

[0019]

As illustrated in Fig. 1, a catheter assembly 1 according to the embodiment is configured to have an indwelling catheter 11 and a paracentesis needle 12. A protector P is attached to the catheter assembly 1 for protecting the indwelling catheter 11.

[0020]

The catheter assembly 1 having the above-mentioned configuration may be in an assembled state (state illustrated in Figs. 1 and 2) where the indwelling catheter 11 and the paracentesis needle 12 are assembled, or an evulsed state (state illustrated in Fig. 3) where the paracentesis needle 12 is evulsed from the indwelling catheter 11. The catheter assembly 1 can be used for the paracentesis into a surface of a living body in the assembled state. Thereafter, the indwelling catheter 11 can be indwelled on the surface of a living body after switching into the evulsed state. Herein, it is possible to connect a connector 20 to the indwelling catheter 11 indwelled on the surface of a living body (see Fig. 4).

[0021]

Here, before describing the catheter assembly 1, the connector 20 will be described referring to Fig. 4.

As illustrated in Fig. 4, the connector 20 has a tubular body and is connected to a base end portion of the indwelling catheter 11. A tip portion of a tube (not illustrated) is connected to the base end portion of the connector 20. Then, a bag (not illustrated) filled with an infusion solution Q is connected to a base end portion of the tube. The infusion solution Q is supplied from the bag in a connected state where

the connector 20 is connected to the indwelling catheter 11 (see Fig. 4).

Further, in order to reliably supply the infusion solution Q, it is preferable that the connector 20 have a locking mechanism (not illustrated) which is engaged with a locking unit 32 provided on an outer periphery of the base end portion of the indwelling catheter 11 so as to be fixed in the indwelling catheter 11.

[0022]

In addition, a tip portion of the connector 20 connected to the base end portion of the indwelling catheter 11 may have a tapered shape in which the outer diameter thereof is gradually decreased toward the tip. Accordingly, when connecting the connector 20, it is possible to easily insert the connector 20 into the base end portion of the indwelling catheter 11. In addition, after the infusion solution Q is supplied, the connector 20 can be easily removed from the base end portion of the indwelling catheter 11. That is, it is possible to easily perform insertion and evulsion operations of the connector 20 with respect to the indwelling catheter 11.

[0023]

Returning to Fig. 1, the description of the catheter assembly 1 according to the embodiment will be continued.

The indwelling catheter 11 is configured to mainly include a hollow catheter 2 and a catheter hub 3, fixed onto a base end portion of the catheter 2, internally having a passage 31 which communicates with the inside of the catheter 2. In addition, in order to facilitate the manual operation for inserting the catheter 2 toward a blood vessel, it is preferable that the catheter hub 3 have a tab 36 protruding from an outer periphery surface thereof.

[0024]

It is preferable that the catheter 2 be a tube that is flexible to some extent. A resin material, particularly, a soft resin material is suitable for the catheter 2 as a component material. Specifically, for example, a fluorine-based resin such as polytetrafluoroethylene (PTFE), ethylene-tetrafluoroethylene copolymer (ETFE) and perfluoroalkoxy fluorine resin (PFA); olefin-based resin such as polyethylene and polypropylene or a mixture thereof; polyurethane; polyester; polyamide; polyether nylon resin; or a mixture of the olefin-based resin and ethylene-vinyl acetate copolymer can be exemplified.

[0025]

It is preferable that the inside of the catheter 2 have visibility to be visually perceivable in its entirety or in a part thereof. That is, it is preferable that the catheter 2 be constituted by a resin which is transparent (colorless transparent), colored transparent or semi-transparent. Accordingly, when the catheter 2 is secured in a blood vessel, it is possible to visually check a phenomenon in which blood R (see Fig. 4) flows into the transparent catheter hub 3 through an intracavity 21 of the catheter 2 (that is, a flashback of blood).

[0026]

In addition, it is also possible to mix an X-ray contrast agent such as barium sulfate, barium carbonate, bismuth carbonate or tungstic acid in the component material of the catheter 2 to impart a contrast imaging function.

[0027]

For example, the base end portion of the catheter 2 is liquid-tightly fixed onto the catheter hub 3 by caulking, fusing (heat fusing, high-frequency fusing or the like) or bonding using a bonding agent. Further, Figs. 2 and 3 illustrate a state

where the catheter 2 and the catheter hub 3 are fixed to each other by a caulking pin 33. The caulking pin 33 has a circular tube portion at the tip side and a tapered portion gradually increased in diameter from the circular tube portion toward the base end side. In other words, the caulking pin 33 is gradually decreased in diameter from the base end side toward the tip side. Therefore, if the infusion solution Q flows in from the base end side, this allows the infusion solution Q to smoothly flow out toward the catheter 2. Since the catheter 2 and the catheter hub 3 are caulked at the circular tube portion, it is preferable that the caulking pin 33 be made of metal or hard resin.

In a case where the catheter 2 and the catheter hub 3 are fixed to each other by the fusing or the bonding agent, it is possible not to employ the caulking pin 33 (not illustrated). Alternatively, in this case, in place of the above-described tapered portion, the passage 31 of the tip portion may be formed in a tapered portion such that the inner diameter thereof is gradually decreased in the tip direction. Accordingly, this tapered portion enables the infusion solution Q to smoothly flow out toward the catheter 2 when the infusion solution Q flows in from the base end side.

[0028]

As illustrated in Fig. 2, the catheter hub 3 is constituted by a member having a tubular body such that an intracavity portion thereof functions as the passage 31. The passage 31 communicates with the intracavity 21 of the catheter 2.

[0029]

It is preferable that the base end portion of the passage 31 of the catheter hub 3 have a tapered shape in which the inner diameter of a wall portion 311 thereof is gradually increased toward the base end direction. It is further preferable that the tapering of the base end portion of the passage 31 of the

catheter hub 3 and the tapering of the tip of the connector 20 be formed in mutually corresponding shape (or similarity in tapering angle). Accordingly, it is possible to easily insert the tip of the tapered connector 20 into the corresponding base end portion of the tapered catheter hub 3 to be connected thereto. In addition, in this connecting manner, the wall portion 311 of the passage 31 tightly contacts the outer periphery portion of the connector 20, thereby maintaining a further liquid-tight state.

[0030]

In addition, in the middle of the passage 31, it is preferable that a step difference portion 35 having a tip side reduced in diameter with respect to the base end side be formed. If an end surface of the tip side of the valve element 7 to be described below is provided to abut on the step difference portion 35, the valve element 7 can be stably fixed thereto.

[0031]

In addition, in the embodiment, as illustrated in Figs. 1 to 4, the valve element 7 is provided so as to block the passage 31. Specifically, as illustrated in Fig. 3, the valve element 7 having a bottomed tubular shape is fixed such that the outer periphery surface of the side wall of the valve element 7 contacts the inner periphery surface of the catheter hub 3. An opening and closing unit 71 (see Fig. 4) capable of being opened and closed is provided at the bottom portion of the valve element 7. The valve element 7 is configured to have a valve mechanism 6 including the opening and closing unit 71, and an operation member 8 to be described below.

[0032]

The opening and closing unit 71 is configured to include a slit 711 (see Figs. 3 and 5) passing through in the thickness direction, to be formed at the center part of the bottom portion.

The shape of the slit 711 may be formed without any particular limitation as long as the operation member 8 can be inserted into the slit and removed therefrom. For example, the bottom portion in a plan view can be formed in a shape of straight line, cross, letter Y (or modified letter Y). Accordingly, the opening and closing unit 71 not only allows the operation member 8 to be inserted into and removed from the slit 711, but also becomes reliably self-occlusive.

[0033]

It is preferable that the valve element 7 be composed of an elastic material having a tightness which is not easily opened by a blood flow. If the valve element 7 is composed of the elastic material, it is possible to smoothly open and close the opening and closing unit 71. As the elastic material composing the valve element 7, for example, various rubber materials such as natural rubber, isoprene rubber, isobutylene-isoprene rubber, butadiene rubber, styrene-butadiene rubber, urethane rubber, nitrile rubber, acrylic rubber, fluororubber, and silicone rubber (particularly, vulcanized rubber); various thermoplastic elastomers such as urethane-based, polyester-based, polyamide-based, olefin-based, and styrene-based thermoplastic elastomers; or various elastic materials made as a mixture of aforementioned materials can be exemplified. Among the elastic materials, particularly, it is preferable that isoprene rubber be employed. If isoprene rubber is employed as the component material of the valve element 7, this allows the valve element 7 to have such advantages as a low permanent compression set and a long duration period thereof.

[0034]

The operation member 8 having a tubular body is arranged such that when one (at the tip side) opening portion 85 thereof

(see Fig. 4) is inserted into the opening and closing unit 71 of the valve element 7, the base end side of the catheter hub 3 communicates with the tip side thereof through the operation member 8. Accordingly, due to the valve mechanism 6, the movement of the operation member 8 along the axial direction of the passage 31 enables the one opening portion 85 to be inserted into and removed from the opening and closing unit 71 of the valve element 7, thereby performing the shut-off (see Fig. 3) and opening (see Fig. 4) of the passage 31.

[0035]

Since in the valve mechanism 6 illustrated in Fig. 3, the entire operation member 8 is positioned closer to the base end side than the opening and closing unit 71, the opening and closing unit 71 is closed due to the self-occlusive property, thereby shutting off the passage 31. On the other hand, in the valve mechanism 6 illustrated in Fig. 4, the opening portion 85 at the tip side of the operation member 8 is positioned at the tip side via passing through the opening and closing unit 71. Therefore, the passage 31 is opened via the intracavity of the operation member 8.

[0036]

As illustrated in Fig. 4, on the tip outer periphery portion of the operation member 8, there are formed two tip diameter expanded portions 81a and 81b of which outer diameters are expanded, that is, protruding along the peripheral direction. The tip diameter expanded portion 81b among the tip diameter expanded portions 81a and 81b functions as an engagement portion engaging with the opening and closing unit 71 of the valve element 7 when the passage 31 is opened after the operation member 8 has passed through the opening and closing unit 71. This engagement of the tip diameter expanded portion 81b with the opening and closing unit 71 of the valve

element 7 prevents the operation member 8 from accidentally moving toward the base end direction, thereby reliably maintaining the open state of the passage 31.

[0037]

In addition, it is preferable that the tip diameter expanded portions 81a and 81b be respectively in a tapered shape. Accordingly, when the operation member 8 passes through the opening and closing unit 71 of the valve element 7, the tip diameter expanded portions 81a and 81b are capable of reliably pushing and outwardly widening the opening and closing unit 71 in sequence thereof, thereby facilitating the operation member 8 to easily pass through. Then, the parts of the operation member 8 (that is, tip diameter expanded portions 81a and 81b) passed through the opening and closing unit 71 are protruded from the opening and closing unit 71.

[0038]

As described above, the operation member 8 is configured to be in a tubular body. Therefore, when the operation member 8 is moved, the outer periphery portion of the operation member 8, for example, a base end diameter expanded portion 84 (see Fig. 4) slides on the wall portion 311 of the passage 31. Accordingly, the movement of the operation member 8 is stably performed.

[0039]

As illustrated in Fig. 4, it is preferable that the inner diameter of the base end diameter expanded portion 84 be the same as or larger than the inner diameter of the connector 20.

Accordingly, when the connector 20 is connected to the base end portion of the catheter hub 3, it is possible to easily and reliably cause the infusion solution Q to flow from the connector 20 to the operation member 8.

[0040]

In the embodiment, a communication unit 9 (see Figs. 2 to 5) is provided on the inner periphery portion of the catheter hub 3 having the valve element 7, or on the periphery edge portion of the valve element 7, such that the base end side of the catheter hub 3 communicates with the tip side thereof.

[0041]

Specifically, as illustrated in Fig. 5, in the middle of the passage 31 of the catheter hub 3, there is formed one or more inner periphery groove portions 9a along the catheter hub 3 in the axial direction from the above-mentioned step difference portion 35 as the communication unit 9.

[0042]

The inner periphery groove portion 9a is provided to prevent air from remaining inside the catheter hub 3, when the needle 4 is evulsed after the paracentesis is performed into a surface of a living body with the catheter 2 and the needle 4. That is, when the needle 4 is evulsed, air closer to the tip side than the valve element 7 is pushed by the flow of the blood R getting into the passage 31 to pass through the inner periphery groove portion 9a, thereby being discharged to the base end side. Further, the shape of the inner periphery groove portion 9a is not particularly limited in shape as long as the inner periphery groove portion 9a can exhibit the above-mentioned function. For example, the shape of the inner periphery groove portion 9a may be formed in a linear fashion on the inner periphery surface of the catheter 2 from the tip side to the base end side, in a corrugated fashion, or in a spiral fashion. In addition, the depth of the inner periphery groove portion 9a is not particularly limited as long as the above-mentioned function can be exhibited. For example, the depth thereof can be set to approximately 5 μm to 20 μm.

[0043]

In the present invention, a sealing member 10 is provided at a space between the valve element 7 and the operation member 8, that is, at the base end side of the valve element 7 so as to block the communication unit 9. The sealing member 10 having a tubular body is sealable, allowing the passage of air yet prohibiting the passage of liquid. Here, the sealing member 10 is arranged to tightly contact the valve element 7 so as to block the inner periphery groove portion 9a. It is preferable that the sealing member 10 be faucet-jointed to the valve element 7 for improving the tightly contacting state. The sealing member 10 can be fixed onto the inner periphery surface of the catheter hub 3 by fusing or a bonding agent. In the valve element 7, displacement of the base end side is suppressed by the sealing member 10 and displacement of the tip side is suppressed by the step difference portion 35. Accordingly, fluctuations of the position are suppressed regardless of the insertion and removal of the operation member 8, and thus it is possible to smoothly perform the opening and closing operation of the valve element 7.

Further, if the communication unit 9 is provided with the periphery edge portion of the valve element 7, the communication unit 9 may be either a through hole passing through the periphery edge portion of the valve element 7, or an outer periphery groove provided on the outer periphery surface of the valve element 7.

[0044]

The employed sealing member 10 is to allow the passage of air yet does not allow the passage of liquid. As the sealing member 10, for example, it is possible to preferably employ a sealing member formed in a porous body such as a sintered body made of polyethylene. The sealing member 10 made of a porous body is easy to be manufactured, thereby having an advantage

in which the sealing member 10 can be precisely manufactured.

[0045]

Here, as another embodiment of the sealing member 10, a sealing member 10′ illustrated in Figs. 6A and 6B can be exemplified. The sealing member 10′ having a molded article 10a made of a resin material and molded in a tubular body including at least one of a hole portion 10b passing through from one end surface 10a1 of the molded article 10a tightly contacting the valve element 7 to the other end surface 10a2 and an outer periphery groove portion (not illustrated in Figs. 6A and 6B) formed on the outer periphery surface, while disposing a hydrophobic filter 10c on the other end surface 10a2. It is also possible to coat at least a part of the hole portion 10b and the outer periphery groove portion of the sealing member 10′ with a water-swelling polymer. As the water-swelling polymer to coat with, a water-swelling polymer which is the same as a water-swelling polymer 10e to be described below can be employed.

[0046]

As the hydrophobic filter 10c, for example, a monolayer sheet or a multilayer sheet made of an olefin resin such as polyethylene or polypropylene, having the thickness of 0.03 mm to 0.3 mm can be employed.

[0047]

As further another embodiment of the sealing member 10, a sealing member 10″ illustrated in Fig. 7 can be exemplified. The sealing member 10″ having the molded article 10a made of a resin material and molded in a tubular body, includes at least one of a hole portion (not illustrated in Fig. 7) passing through from one end surface 10a1 in which the molded article 10a tightly contacts the valve element 7 to the other end surface 10a2 and an outer periphery groove portion 10d formed on the outer

periphery surface. At least a part of the inside of the hole portion and the inside of the outer periphery groove portion 10d is coated with the water-swelling polymer 10e.

[0048]

As the water-swelling polymer 10e, for example, polyvinyl-pyrrolidone; methyl vinyl ether-maleic anhydride copolymer; an acrylamide-acrylate copolymer such as a dimethylacrylamide-glycidyl methacrylate copolymer; a water-soluble synthetic polymer such as sodium polyacrylate, polyacrylamide, polystyrene sulfonate, polyvinyl alcohol, polyethylene oxide and polyethylenimine; a water-soluble semi-rigid polymer such as carboxymethyl starch, dialdehyde starch, carboxymethyl cellulose and hydroxyethyl cellulose; a water-soluble natural polymer such as tannin, lignin, alginic acid, gum Arabic, guar gum, gum tragacanth, gelatin, casein and collagen can be exemplified.

[0049]

As the molded article 10a, for example, various resin materials such as: polyethylene, polypropylene, polyolefin such as ethylene-vinyl acetate copolymer, polyurethane, polyamide, polyester, polycarbonate, polybutadiene, and polyvinyl chloride can be employed.

[0050]

As illustrated in Figs. 1 and 2, a paracentesis needle 12 is configured to include a needle 4 and a needle hub 5.

As illustrated in Fig. 2, the base end portion of the needle 4 is fixed onto the needle hub 5. In an assembled state, the catheter assembly 1 is configured by inserting the needle 4 into the catheter 2, the valve element 7 and the operation member 8 such that a sharp needle point 41 of the needle 4 protrudes from the tip opening portion 22 of the catheter 2. Then, the needle point 41 is used for the paracentesis into a

surface of a living body. In addition, in the assembled state, the tip of the needle hub 5 is inserted into the base end portion of the catheter hub 3 to be fitted thereto.

[0051]

A groove (not illustrated) may be provided at the outer periphery portion of the needle 4 along the axial direction of the needle 4. The groove functions as an introduction passage introducing the blood R into the intracavity 21 of the catheter 2 when the blood vessel paracentesis is performed. The blood R introduced from the groove flows into a gap between the needle 4 and the catheter 2. Accordingly, it is possible to reliably check the flashback of the blood R from an early stage. Then, the blood R passes through the intracavity 21 of the catheter 2 to flow into the passage 31 of the catheter hub 3.

[0052]

For example, as a component material of the needle 4, a metal material such as stainless steel, aluminum or aluminum alloy, titanium or titanium alloy can be exemplified.

[0053]

The needle hub 5 fixed (or adhered) to the base end portion of the needle 4, having a tubular shape, includes an air filter (not illustrated) to be disposed at the base end opening portion of the needle hub 5.

[0054]

It is preferable that the catheter hub 3, the operation member 8 and the needle hub 5 described above be configured of a resin which is transparent (colorless transparent), colored transparent or semi-transparent, thereby securing visibility of the inside thereof. Accordingly, when the catheter 2 is secured in the blood vessel, the flashback of the blood R can be visually checked.

[0055]

For example, as a component material of the catheter hub 3, the operation member 8 and the needle hub 5, various resin materials such as polyolefin like polyethylene, polypropylene and ethylene-vinyl acetate copolymer, polyurethane, polyamide, polyester, polycarbonate, polybutadiene and polyvinyl chloride can be exemplified.

[0056]

The above-described catheter assembly 1 according to the embodiment is used as follows.

First, a protector P is removed from the catheter assembly 1 in a state where the needle 4 is inserted into the catheter 2. Next, the catheter hub 3 is grasped to perform the blood vessel paracentesis to a patient with the needle 4. If the catheter 2 is secured in the blood vessel , the blood R flows to the base end direction through the space between the catheter 2 and the needle 4 based on the blood pressure. Since the catheter 2 or the catheter hub 3 is formed of a material which is colorless transparent, colored transparent or semi-transparent, flow of the blood R is visually perceivable. The flow of the blood R reaches a place where the valve element 7 of the passage 31 is positioned. At this time, air confined between the blood R and the valve element 7 is discharged to the base end side of the sealing member 10 (or 10′, 10″) via the sealing member 10 (or 10′, 10″) passing through the communication unit 9 (that is, inner periphery groove portion 9a). After the flow of the blood R is visually perceived, the catheter assembly 1 is further advanced for a very small distance toward the tip direction. Specifically, the catheter 2 is advanced forward to a predetermined position inside the blood vessel by holding the tab 36 formed on the outer periphery surface of the catheter hub 3 with fingers.

[0057]

After the catheter 2 is secured in the blood vessel, the catheter 2 or the catheter hub 3 is held by one hand, while the needle hub 5 is grasped by the other hand to be pulled toward the base end direction. Then, the needle 4 is evulsed from the catheter 2 (see Figs. 2 and 3). Accordingly, the catheter assembly 1 is turned into a disassembled state. At this time, since the opening and closing unit 71 of the valve element 7 is in a closed state in the indwelling catheter 11, the blood R inside the passage 31 is prevented from leaking out to the outside. In addition, since the above-mentioned sealing member 10 tightly contacting the valve element 7 is provided inside the catheter hub 3, it is possible to prevent the blood R from leaking out from the inside of the catheter hub 3 when the needle 4 is evulsed. Further, the evulsed paracentesis needle 12 is no longer necessary, thereby being discarded.
[0058]

Next, the catheter hub 3 of the indwelling catheter 11 is fixed onto the skin using an adhesive tape or the like. Then, the connector 20 is connected to the catheter hub 3 (see Fig. 4). This connection allows the operation member 8 to be pressed by the connector 20, thereby to be moved in the tip direction such that the opening portion 85 at one side of the operation member 8 passes through the valve element 7. Accordingly, the passage 31 is turned into an open state.
[0059]

Next, supply of the infusion solution Q is started. In this manner, the infusion solution Q, sequentially passing through the inside of the connector 20 and the inside of the operation member 8, flows out from the opening portion 85 at one side of the operation member 8, thereby filling the entire passage 31 with the infusion solution Q (that is, priming completed) (see Fig. 4).

Reference Signs List

[0060]

1 catheter assembly

11 indwelling catheter

12 paracentesis needle

2 catheter

21 intracavity

22 tip opening portion

3 catheter hub

31 passage

311 wall portion

32 locking unit

33 caulking pin

35 step difference portion

36 tab

4 needle

41 needle point

5 needle hub

6 valve mechanism

7 valve element

71 opening and closing unit

711 slit

8 operation member

81a, 81b tip expanded diameter portion

84 base end expanded diameter portion

85 opening portion

9 communication unit

9a inner periphery groove portion

10 sealing member

10a1, 10a2 end surface

10a molded article

10b hole portion

10c hydrophobic filter

10d outer periphery groove portion

10e water-swelling polymer

20 connector

P protector

CLAIMS

[Claim 1]

A catheter assembly comprising:

a hollow catheter;

a catheter hub, fixed onto a base end portion of the catheter, internally having a passage communicating with an internal portion of the catheter;

a needle inserted into the catheter;

a needle hub, fixed onto a base end portion of the needle, capable of being connected to a base end side of the catheter hub;

a valve element, positioned to block the passage, and having an opening and closing unit capable of being opened and closed;

an operation member having a tubular body, arranged such that the base end side of the catheter hub communicates with a tip side thereof when one opening portion of the operation member is inserted into the opening and closing unit; and

a communication unit, provided with an inner periphery portion of the catheter hub including the valve element or a peripheral edge portion of the valve element such that the base end side of the catheter hub communicates with the tip side thereof, wherein a sealing member having a tubular body and allowing the passage of air yet prohibiting the passage of liquid, is provided between the valve element and the operation member so as to block the communication unit.

[Claim 2]

The catheter assembly according to Claim 1, wherein the sealing member is a porous body.

[Claim 3]

The catheter assembly according to Claim 1, wherein

the sealing member has a tubular molded article,

the molded article includes at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article, and

the other end surface of the molded article is provided with a hydrophobic filter.

[Claim 4]

The catheter assembly according to Claim 3, wherein

at least a part of the hole portion and the outer periphery groove portion is coated with a water-swelling polymer.

[Claim 5]

The catheter assembly according to Claim 1, wherein

the sealing member has a tubular molded article,

the molded article includes at least one of a hole portion passing through from one end surface of the molded article arranged to tightly contact the valve element to the other end surface of the molded article, and an outer periphery groove portion formed on the outer periphery surface of the molded article, and

at least a part of an internal portion of the hole portion and an internal portion of the outer periphery groove portion is coated with a water-swelling polymer.