peritoneal dialysis; and 7) provides minimal or no outflow failure. The present inventive catheter will allow for peritoneal dialysis to be a successful modality for long-term dialysis, thereby overcoming many of the aforementioned limitations in current dialysis machines.

Summary of the Invention

The present ~~invention~~ disclosure discloses a catheter, preferably made of silicone, for use in peritoneal dialysis. The basic and main section of the catheter comprises an inner diameter and an outer diameter. The catheter comprises one or more inflow sets of tubes and one or more outflow sets of tubes. The initial or extra-peritoneal portion of the silicone catheter has the inflow tail end and the outflow tail end. Both main tails, i.e., main tail end of outflow tube and main tail end of inflow tube, are connected to a dialysis machine. The opposite end of the catheter device is implanted into the abdominal wall for conducting peritoneal dialysis. On the distal end, the inflow tube preferably bifurcates into two smaller inflow (with respect to the patient) auxiliary tubes, and the outflow tube preferably splits into three smaller outflow auxiliary tubes. All of the smaller auxiliary tubes (preferably five in total) contain a plurality of small side-wall apertures for the rapid and efficient movement of dialysis solution in and out of the peritoneal cavity by passing the same into and out of the tubes. The silicone catheter is preferably provided with two encircling Dacron cuffs to anchor the catheter in abdominal wall tissues after implantation. The distal or intra-abdominal portion of the catheter with tubes is initially covered by a sheath prior to implantation in the peritoneal cavity, for ease of implantation. After the tubes are properly located within the peritoneal cavity, the sheath is removed, thereby deploying and separating the smaller inflow tubes and the smaller outflow tubes within the peritoneal cavity. When released from the sheath, the tubes preferably form an

open "basket." Through this device, dialysis solution can continually enter the peritoneal cavity through the apertures in the inflow auxiliary tubes and continually be removed from the peritoneal cavity through the apertures in the outflow auxiliary tubes. This reduces the time required to complete the dialysis exchange procedure and increases its efficiency by (a) maximizing effective surface area of the peritoneal membrane; (b) maximizing the concentration gradient across the peritoneal membrane for solute and water removal; (c) maximizing peritoneal fluid removal by recruiting separate outflow tubes and preventing outflow failure; (d) minimizing the recirculation of dialysate by providing separate inflow and out flow system; and (e) minimizing the time spent on dialysis by continuous and efficient use of dwell time. The present invention also comprises a tube adapted for selective receipt of a fiber optic borescope to allow a physician conducting the dialysis to look into the peritoneal cavity via a real image transfer video camera. The addition of this tube to allow insertion of a fiber optic borescope helps a physician to check on proper functioning of the dialysis and to aid in the diagnosis of any problems presented during the procedure.

In an aspect, there is provided a catheter for use in continuous flow peritoneal dialysis, comprising: an inflow tube, comprising a length of tubing having an inner diameter and an outer diameter, said inflow tube divided into a plurality of separate inflow auxiliary tubes, said inflow auxiliary tubes configured to pass dialysis fluid directly from said inflow tube to a peritoneal cavity; and an outflow tube, comprising a length of tubing having an inner diameter and an outer diameter, said outflow tube divided into a plurality of separate outflow auxiliary tubes, said outflow auxiliary tubes configured to pass dialysis fluid directly from the peritoneal cavity to said outflow tube; wherein each of said inflow tube and said outflow tube has a connection means for securing the same to a dialysis machine; wherein each of said inflow auxiliary tubes and said outflow auxiliary tubes contains a plurality of

apertures for simultaneous movement of dialysis fluid in and out of the peritoneal cavity; wherein said inflow auxiliary tubes and said outflow auxiliary tubes are expandable to define an open-basket shape, and wherein all of said auxiliary tubes are separate and connected at their distal ends by a non-traumatic end cap; and wherein said apertures on said inflow auxiliary tubes and said apertures on said outflow auxiliary tubes throughout a perimeter of said open-basket shape are configured to provide unobstructed free-flow of dialysis fluid throughout the peritoneal cavity while maximizing the surface area of the peritoneal cavity directly targeted by the dialysis fluid released from said apertures in said inflow auxiliary tubes.

Brief Description of the Drawings

Fig. 1A is a front perspective view the present invention, a high flux basket-like catheter for efficient continuous flow peritoneal dialysis, in its expanded state as would be within the abdomen of a patient after removal of the sheath;

FIG. 1B is a cross-sectional view of the present inventive catheter at the lines A-A of FIG. 1A showing an upstream single inflow tube and a single outflow tube, prior to the splitting of each into a plurality of inflow and outflow auxiliary tubes, respectively, as well as a tube for selective receipt of a fiber optic scope;

What is Claimed:

1. A catheter for use in continuous flow peritoneal dialysis, comprising:

an inflow tube, comprising a length of tubing having an inner diameter and an outer diameter, said inflow tube divided into a plurality of separate inflow auxiliary tubes, said inflow auxiliary tubes configured to pass dialysis fluid directly from said inflow tube to a peritoneal cavity; and

an outflow tube, comprising a length of tubing having an inner diameter and an outer diameter, said outflow tube divided into a plurality of separate outflow auxiliary tubes, said outflow auxiliary tubes configured to pass dialysis fluid directly from the peritoneal cavity to said outflow tube;

wherein each of said inflow tube and said outflow tube has a connection means for securing the same to a dialysis machine;

wherein each of said inflow auxiliary tubes and said outflow auxiliary tubes contains a plurality of apertures for simultaneous movement of dialysis fluid in and out of the peritoneal cavity; wherein said inflow auxiliary tubes and said outflow auxiliary tubes are expandable to define an open-basket shape, and wherein all of said auxiliary tubes are separate and connected at their distal ends by a non-traumatic end cap; and wherein said apertures on said inflow auxiliary tubes and said apertures on said outflow auxiliary tubes throughout a perimeter of said open-basket shape are configured to provide unobstructed free-flow of dialysis fluid throughout the peritoneal cavity while maximizing the surface area of the peritoneal cavity directly targeted by the dialysis fluid released from said apertures in said inflow auxiliary tubes.

2. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of inflow auxiliary tubes is preferably two.

3. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of outflow auxiliary tubes is preferably three.

4. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of said outflow auxiliary tubes is greater than the number of said

inflow auxiliary tubes.

5. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein a retractable sheath is initially provided over said inflow and outflow auxiliary tubes prior to expansion of the open-basket configuration.

6. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube are preferably about 32 cm long.

7. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube preferably has an inner diameter of about 2.5 mm.

8. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube preferably has an outer diameter of about 3.5 mm.

9. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said apertures on said inflow auxiliary tubes and said outflow auxiliary tubes are preferably no larger than 0.5 mm.

10. The catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said end cap is preferably round.

What is Claimed:

1. A catheter for use in continuous flow peritoneal dialysis, comprising:

an inflow tube, comprising a length of tubing; and

an outflow tube, comprising a length of tubing;

wherein each of said inflow tube and said outflow tube has a proximal connection means for securing the same to a dialysis machine;

said inflow tube dividing into two or more separate, smaller inflow auxiliary tubes;

said outflow tube dividing into two or more separate, smaller outflow auxiliary tubes;

wherein all of said auxiliary tubes contain a plurality of fluid-conveying apertures;

wherein at least a segment of said inflow auxiliary tubes and said outflow auxiliary tubes are encased in a single, outer tube; and

wherein said outer tube further comprises a separate tube which is adapted for receipt of a fiber optic borescope for viewing the dialysis procedure.

2. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of inflow auxiliary tubes is preferably two.

3. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of outflow auxiliary tubes is preferably three.

4. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of said outflow auxiliary tubes is greater than the number of said inflow auxiliary tubes.

5. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein a retractable sheath is initially provided over said inflow and outflow auxiliary tubes.

6. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube has an inner diameter of about 2.5 mm.

7. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube preferably has an outer diameter of about 4.0 mm.

8. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said apertures on said inflow auxiliary tubes and said outflow auxiliary tubes are preferably no larger than 0.5 mm.

9. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said inflow auxiliary tubes and said outflow auxiliary tubes define an open-basket shape.

10. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein all of said auxiliary tubes are connected by a non-traumatic end cap.

11. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 10, wherein said end cap is preferably round.

12. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube is preferably about 320 mm long.

13. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube preferably has an inner diameter of about 3.5 mm.

14. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube preferably has an outer diameter of about 4.0 mm.

15. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube connecting to said inflow tube and said outflow tube at a base section, said base section defining a Y-shaped connection at said inflow tube and said outflow tube.

16. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said two or more smaller inflow auxiliary tubes and said two or more smaller outflow auxiliary tubes extend within and through said outer tube.

17. A catheter for use in continuous flow peritoneal dialysis, comprising:

an inflow tube, comprising a length of tubing having an inner diameter, and an outer diameter; and

an outflow tube, comprising a length of tubing having an inner diameter, and an outer diameter;

wherein each of said inflow tube and said outflow tube has a connection means for securing the same to a dialysis machine;

said inflow tube having a plurality of separate, smaller inflow auxiliary tubes;

said outflow tube having a plurality of separate, smaller outflow auxiliary tubes; and

wherein said auxiliary tubes contain a plurality of apertures for movement of fluid in and out of the peritoneal cavity.

18. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of inflow auxiliary tubes is preferably two.

19. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of outflow auxiliary tubes is preferably three.

20. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of said outflow auxiliary tubes is greater than the number of said inflow auxiliary tubes.

21. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein a retractable sheath is initially provided over said inflow and outflow auxiliary tubes.

22. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube are preferably about 32 cm long.

23. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube preferably has an inner diameter of about 2.5 mm.

24. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube preferably has an outer diameter of about 3.5 mm.

25. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein said apertures on said inflow auxiliary tubes and said outflow auxiliary tubes are preferably no larger than 0.5 mm.

26. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein said inflow auxiliary tubes and said outflow auxiliary tubes define an open-basket shape.

27. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein all of said auxiliary tubes are connected by a non-traumatic end cap.

28. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 27, wherein said end cap is preferably round.

AMENDED CLAIMS
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1. A catheter for use in continuous flow peritoneal dialysis, comprising:

an inflow tube, comprising a length of tubing; and

an outflow tube, comprising a length of tubing;

wherein each of said inflow tube and said outflow tube has a proximal connection means for securing the same to a dialysis machine;

said inflow tube dividing into two or more separate, smaller inflow auxiliary tubes, said inflow auxiliary tubes configured to transport fresh dialysis solution into the peritoneal cavity during a dialysis procedure;

said outflow tube dividing into two or more separate, smaller outflow auxiliary tubes, said outflow auxiliary tubes configured to remove spent dialysis solution containing toxins, waste dialysate and other ultra-filtered fluids out of the peritoneal cavity during dialysis and simultaneously with said transport by said inflow auxiliary tubes;

wherein all of said auxiliary tubes contain a plurality of fluid-conveying apertures;

wherein at least a segment of said inflow auxiliary tubes and said outflow auxiliary tubes are encased in a single, outer tube;

wherein said outer tube further comprises a separate tube which is adapted for receipt of a fiber optic borescope for viewing the dialysis procedure; and

wherein said inflow auxiliary tubes and said outflow auxiliary tubes define an open-basket-like shape upon implantation into the peritoneal cavity.

2. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of inflow auxiliary tubes is preferably two.

3. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of outflow auxiliary tubes is preferably three.

4. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein the number of said outflow auxiliary tubes is greater than the number of said inflow auxiliary tubes.

5. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein a retractable sheath is initially provided over said inflow and outflow auxiliary tubes.

6. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube has an inner diameter of 2.5 mm.

7. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein each of said inflow tube and said outflow tube preferably has an outer diameter of 4.0 mm.

8. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said apertures on said inflow auxiliary tubes and said outflow auxiliary tubes are preferably no larger than 0.5 mm.

9.

10. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein all of said auxiliary tubes are connected by a non-traumatic end cap.

11. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 10, wherein said end cap is preferably round.

12. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube is 320 mm long.

13. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube preferably has an inner diameter of 3.5 mm.

14. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube preferably has an outer diameter of 4.0 mm.

15. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said single, external tube connecting to said inflow tube and said outflow tube at a base section, said base section defining a Y-shaped connection at said inflow tube and said outflow tube.

16. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 1, wherein said two or more smaller inflow auxiliary tubes and said two or more smaller outflow auxiliary tubes extend within and through said outer tube.

17. A catheter for use in continuous flow peritoneal dialysis, comprising:

an inflow tube, comprising a length of tubing having an inner diameter, and an outer diameter; and

an outflow tube, comprising a length of tubing having an inner diameter, and an outer diameter;

wherein each of said inflow tube and said outflow tube has a connection means for securing the same to a dialysis machine;

said inflow tube having a plurality of separate, smaller inflow auxiliary tubes, said inflow auxiliary tubes configured to transport fresh dialysis solution into the peritoneal cavity during dialysis;

said outflow tube having a plurality of separate, smaller outflow auxiliary tubes, said outflow auxiliary tubes configured to remove spent dialysis fluid and other ultra-filtered bodily fluids out of the peritoneal cavity during dialysis and simultaneously with said transport by said inflow auxiliary tubes;

wherein said auxiliary tubes contain a plurality of apertures for movement of fluid in and out of the peritoneal cavity; and

wherein said inflow auxiliary tubes and said outflow auxiliary tubes define an open-basket shape upon implantation into the peritoneal cavity.

18. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of inflow auxiliary tubes is preferably two.

19. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of outflow auxiliary tubes is preferably three.

20. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein the number of said outflow auxiliary tubes is greater than the number of said inflow auxiliary tubes.

21. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein a retractable sheath is initially provided over said inflow and outflow auxiliary tubes.

22. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube are preferably about 32 cm long.

23. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube preferably has an inner diameter of about 2.5 mm.

24. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein each of said inflow tube and said outflow tube preferably has an outer diameter of about 3.5 mm.

25. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein said apertures on said inflow auxiliary tubes and said outflow auxiliary tubes are preferably no larger than 0.5 mm.

26. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein said inflow auxiliary tubes and said outflow auxiliary tubes define an open-basket shape.

27. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 17, wherein all of said auxiliary tubes are connected by a non-traumatic end cap.

28. A catheter for use in continuous flow peritoneal dialysis as claimed in claim 27, wherein said end cap is preferably round.