Chapter 10
Peritoneal Dialysis Connectology

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Conventionally, term *connectology* refers to the body of available information and accumulated experience on the various systems of transfer sets, connecting devices, etc., that are used during the process of peritoneal dialysis (PD). This chapter will cover connectology as it refers to continuous ambulatory peritoneal dialysis (CAPD), with only a brief discussion of automated peritoneal dialysis (APD). Acute peritoneal dialysis is not discussed.

Following the initial rapid evolution of the various systems and connections, which accompanied the development of PD as a treatment of chronic renal insufficiency, there is a relative deceleration of the evolution of PD connectology. This fact could be attributed, on one hand, to the drastic decrease of the frequency of peritonitis, but, on the other hand, to a decline of PD expansion. Lack of evidence-based information or double-blind studies on connectology reflects this stagnancy.

Short History

Georg Ganter was the first who tried to put PD in clinical practice [1]. Back in 1923, in Germany, he used a sterile solution containing electrolytes and dextrose. This solution, placed in large boiled glass bottles, was instilled into the peritoneal cavity through a simple hollow needle, with a rubber tubing serving as the conduit between the bottle and the needle. Later, in the mid-1940s in Holland, P.S.M. Kop used porcelain containers for the dialysis solution, latex tubing, and a glass catheter to instill the solution into the patient's peritoneal cavity [2]. A couple of years later, in Massachusetts, A. Seligman, J. Fine, and H. Frank improved this system by using two catheters, one for the inflow and one for the outflow procedure [3]. In 1952, Arthur Grollman described for the first time a method for intermittent PD using 1-L glass containers with a cap that connected to plastic tubing attached to a flexible polyethylene catheter with very small holes in its distal end [4].

Morton Maxwell took one step further, by developing the "Maxwell Technique." He used two custom-made 1-L glass bottles with plastic tubing and a polyethylene catheter for the inflow. After a 30 min dwell, the fluid was drained back into the two original bottles placed lower than the patient's abdomen. This system simplified PD and made it more easily available [5].

In 1960, Fred Boen, working with B. Scribner in Seattle, introduced home PD, when he developed an automated unit using 40-L "carboy" containers equipped with an automatic device that would open and close a switch to lead the fluid in and out of the peritoneum during the 24 h of dialysis. These containers were filled and sterilized at the University of Washington and then delivered to the patient's home. Peritoneal access was achieved by placing a new catheter before each dialysis (once a week at that time) and removing it afterwards [6]. Boen's system was simplified by Henry Tenckhoff, working in the same center in 1963. He used a reverse osmosis water purification system mixed with a concentrated peritoneal fluid and a simple automatic PD machine. Later, Tenckhoff improved the silicone catheter originally developed by Russell Palmer [7] and completed an intermittent PD system [8]. During the same time, Norman Lasker in New Jersey introduced the first peritoneal cycler that used 2-L glass bottles and instilled warm dialysate in the peritoneal cavity [9].

In 1975, in Austin, Texas, Jack Moncrief and Robert Popovich conceived the method of CAPD using two 1-L glass bottles, plastic tubing, and Tenckhoff's catheters [10, 11]. However, a high incidence of peritoneal infections was the major drawback of their method (Fig. 10.1).

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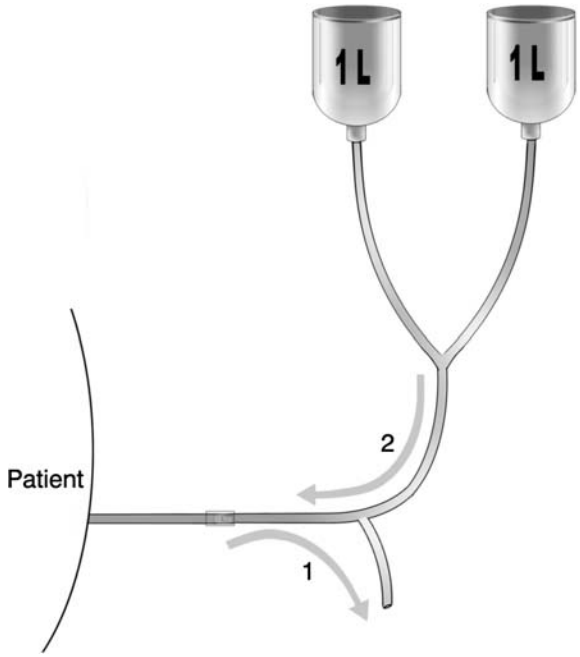

Fig. 10.1 The original CAPD system by R. Popovich and J. Moncrief

In the early 1970s, Dimitrios Oreopoulos had established a 70-patient intermittent PD program in Toronto Western Hospital, using Lasker's cyclers and Tenckhoff's catheters. He was using collapsible 2-L bags. Adopting the idea of CAPD, Oreopoulos developed a tubing with a spike on the one end, to fit into the bag, and a male press fitting on the other, to fit into the catheter. The empty dialysate bag was rolled up and remained attached to the patient's body until the next bag exchange. At that time, all 70 patients in the Toronto Western Hospital intermittent PD program were converted to CAPD. This gave a major push to the then newborn method, particularly because the peritonitis rate was reduced drastically from one episode per 10 weeks to one episode per 8–11 months [12]. "Peritoneal dialysis was here to stay" [13].

Ideal PD Delivery Systems

A PD system should be characterized by reliability, simplicity, ease of use, and acceptable cost. Its materials should be durable, biocompatible, easily disposable, and recyclable. Furthermore, the connection system should not add to the aesthetic drawback of the presence of the peritoneal catheter in the patient's abdomen. Most importantly, a PD system should be safe and effective in preventing PD-related infections.

Description of Various Delivery Systems

CAPD delivery systems include:

Nondisconnecting systems:

- Collapsible bags with simple spike (or Luer lock)
- Collapsible bags with simple spike and germicidal ultraviolet (UV) chamber
- Collapsible bags with simple spike and thermoclave
- ANDY® system (Y-set system)

Disconnecting systems:

- Y-set systems
- O-set systems (a subclass of the Y-set systems)
- T-set systems (a subclass of the double-bag systems)
- Double-bag (or twin-bag) with Y-set systems
- UV flash® system (Y-set sterilized by UV light)
- Safe lock®
- Safe lock 5F®
- ANDY-disc® system (double-bag Y-set system)
- Stay-Safe®
- UltraBag®
- Delta 4 system
- Gemini
- Gambrosol® Trio

The first PD delivery system that made the wide clinical application of CAPD possible was the wearable bag system introduced by Oreopoulos in the late 1970s [12] (Figs 10.2a–10.2c). In this "wearable" system, referred to as the "standard" system for many years, the catheter is connected to the bag *via* a titanium adaptor, which replaced the male press fitting and a piece of tubing and a spike or a Luer lock device. During each bag exchange procedure, the spent dialysate is drained from the peritoneal cavity to the empty bag, which is then disconnected and discarded. The next step is the connection of a new bag to the patient's catheter and the fresh dialysate is introduced into the peritoneal cavity. The empty bag is rolled up and remains attached to the patient until the next bag exchange (nondisconnecting system). This system achieved a significant drop in peritonitis rate. However, this rate was stabilized at approximately one peritonitis episode every year, mostly due to touch contamination.

A major improvement was the introduction of the Y-set system by Buoncristiani [14] (Fig. 10.3). A Y-shaped transfer set filled with disinfectant during the dwell time is connected permanently to the catheter. During the bag exchange procedure, one of the two free limbs of the Y transfer set is connected to a new bag containing the fresh dialysate and the other to an empty drainage bag. At the beginning of each exchange, the spent dialysate is drained from the peritoneal cavity into the empty bag. The Y-connecting tubing is then flushed with a small volume (~100 mL) of fresh dialysate drained from the new bag directly into the drainage bag (flush before fill). After that, the fresh dialysis solution is introduced into the patient's abdomen and the Y-set, along with the bags, is disconnected from the catheter (disconnecting system). With this technique, micro-organisms that happen to be inadvertently introduced into the system during the connection are flushed into the drainage bag.

A number of variants of the original Y-set have been introduced into clinical practice[15–17]. The most widely used are the long Y-set (a Y with two long free limbs) and the O-set (named from the shape it takes when the two free limbs are connected to each other during the dwell phase) (Figs 10.4a and 10.4b). In both systems the prosthesis is disconnected after each exchange. In some versions, the Y- or O-set is filled with disinfectant during the dwell time and reused in the next exchange.

The **double (or twin)-bag system,** introduced by Bazzato et al. [18], is similar to the Y-set system, but both bags (the one containing the fresh solution and the empty-drainage bag) are already connected to the Y-shaped tubing by the manufacturer. The Y-set lies on the bag side. Therefore, only one connection is required by the patient, that of the catheter to the free branch of the Y-set via a catheter extension (Fig. 10.5).

A modification of the double-bag system is the T-set, which consists of a catheter extension equipped with a very short lateral limb, through which, at the end of the exchange, before the disconnection of the bag, a disinfectant is injected, filling the catheter extension [19] (Fig. 10.6).

In the early years of the various Y-set systems, the tubing was rinsed with a hypochlorite disinfectant during bag exchange. However, a danger of accidental infusion of the disinfectant into the peritoneal cavity was always present. Many studies have confirmed that the "flush before fill" is the main preventive characteristic of the Y-sets [20–23]. Therefore, the use of the disinfectant has been abandoned by most manufacturers. In a recent position paper, Buoncristiani et al. [24] propose a double Y-set consisting of one Y-shaped connector mounted on the catheter and a second mounted on the distal end of the down flow tube of the fresh dialysate bag equipped with a special slider (manual or electromechanical) in order to overcome the injection of disinfectant into the peritoneal cavity.

Double-bag systems are currently the mainstay of treatment and they are considered as the "standard" PD delivery system.

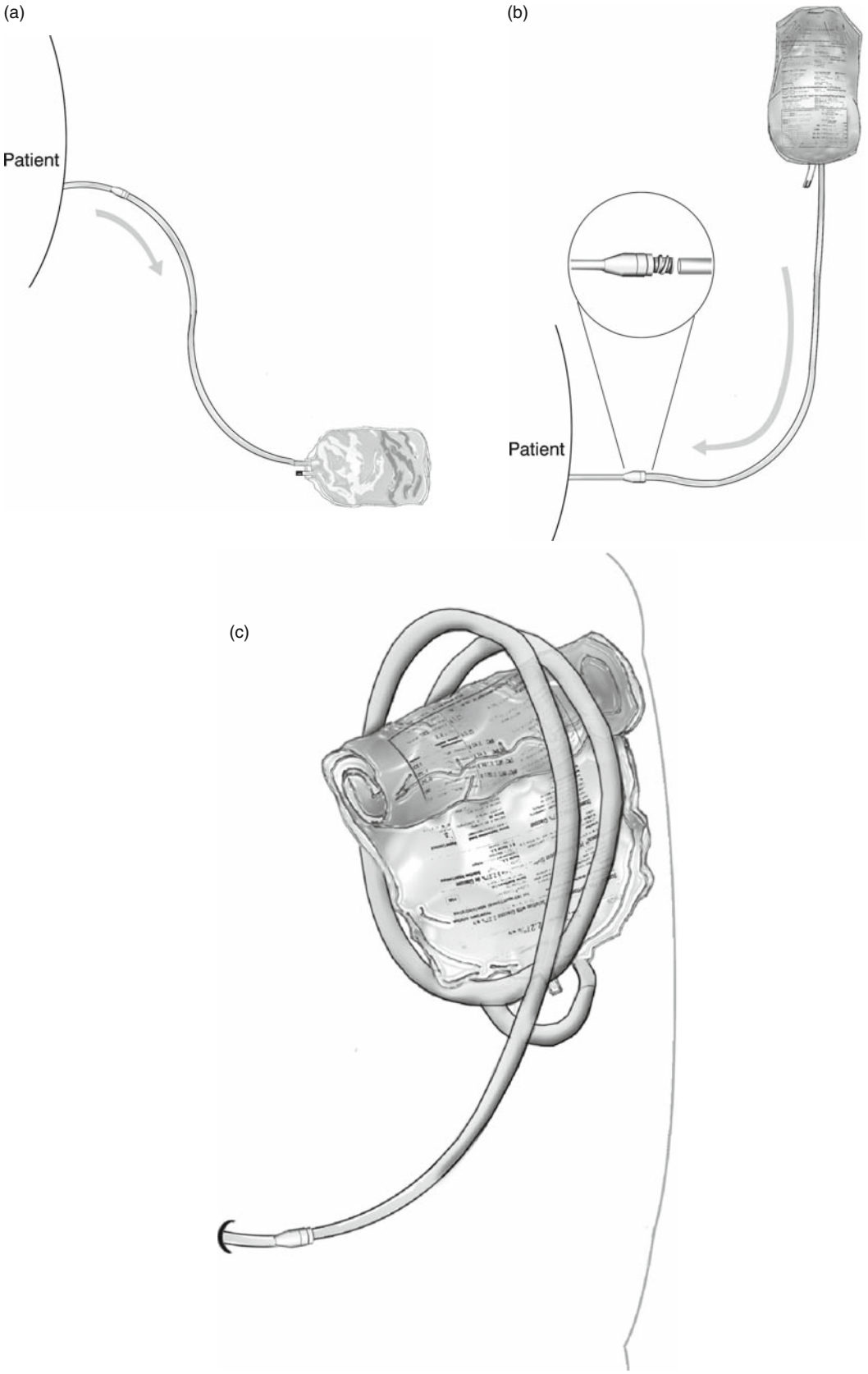

Fig. 10.2 The Oreopoulos wearable or "standard" CAPD system. (**a**) drain, (**b**) fill, (**c**) dwell

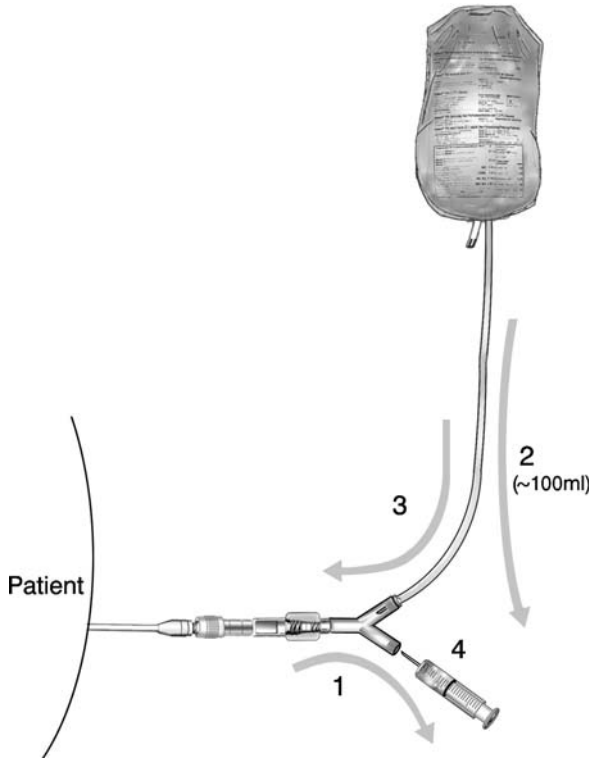

Fig. 10.3 The Y-set CAPD system. (1) drain, (2) flush before fill, (3) fill, (4) fill with disinfectant

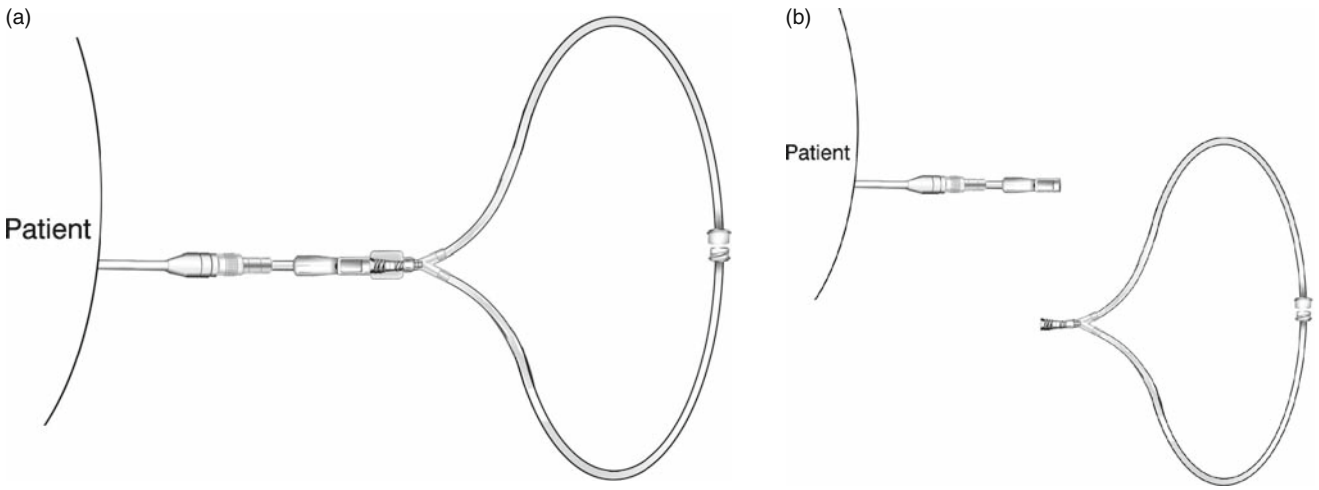

Fig. 10.4 The O-set CAPD system. (**a**) connected, (**b**) disconnected

Connection Devices (Connectors)

In the nondisconnecting systems era, a long transfer set, which consisted of a PVC tubing, was used to connect the catheter with the dialysate bag. The proximal end of this transfer set was connected through a male press fitting to the permanent peritoneal catheter. Frequent accidental disconnections at this point were accompanied by a high incidence of dialysate leak. The introduction of titanium adaptors (Fig. 10.7), which replaced the male press fitting connectors, reduced significantly these accidents and, consequently, peritonitis rates.

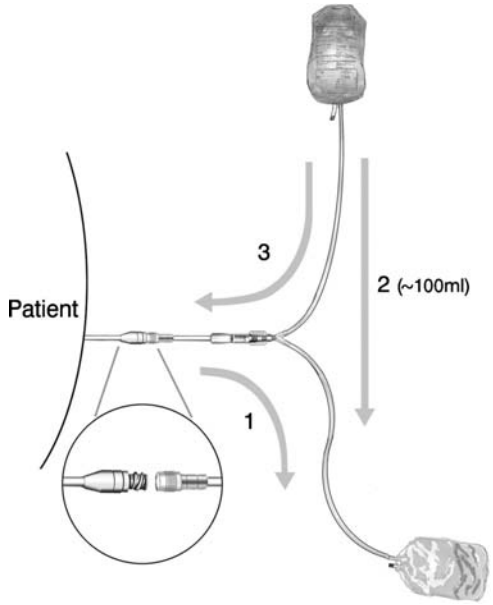

Fig. 10.5 The double-bag CAPD system. (1) drain, (2) flush before fill, (3) fill

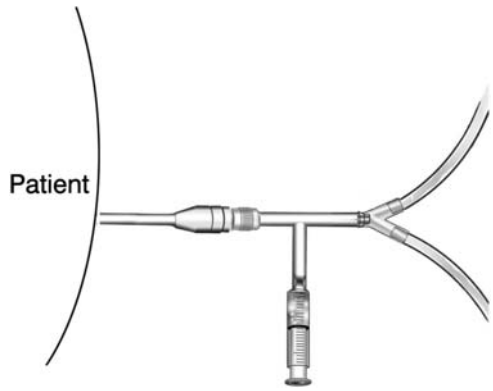

Fig. 10.6 The T-set CAPD system

The distal end of the transfer set was connected to the fresh dialysate bag via a spike (rigid pointed hollow plastic tube) (Fig. 10.8) or a Luer lock connector during each bag exchange procedure (Fig. 10.9). This procedure is associated with a high peritonitis risk due to touch contamination and, therefore, is not recommended [25]. In nondisconnecting systems, transfer sets were initially changed every week and later every month.

In disconnecting systems, a catheter extension tubing is securely screwed onto the titanium adaptor and is connected with the tubing of the dialysate bag at every bag exchange via a connection device that differs from one manufacturer to the other, as described below under "Internationally Available CAPD Delivery Systems". Material improvements have allowed catheter extension changes to be performed approximately every 6 months.

One type of connector was the Safe-lock®, consisting of a cone and a press-fit of the cone, which was deeply recessed, so that the path of the dialysate could not be touched. The Safe-Lock 5F® contained a spring-operated sealing valve inside the catheter, which regulated the dialysate flow in five steps. No extension sets were required and

Fig. 10.7 The titanium adaptor

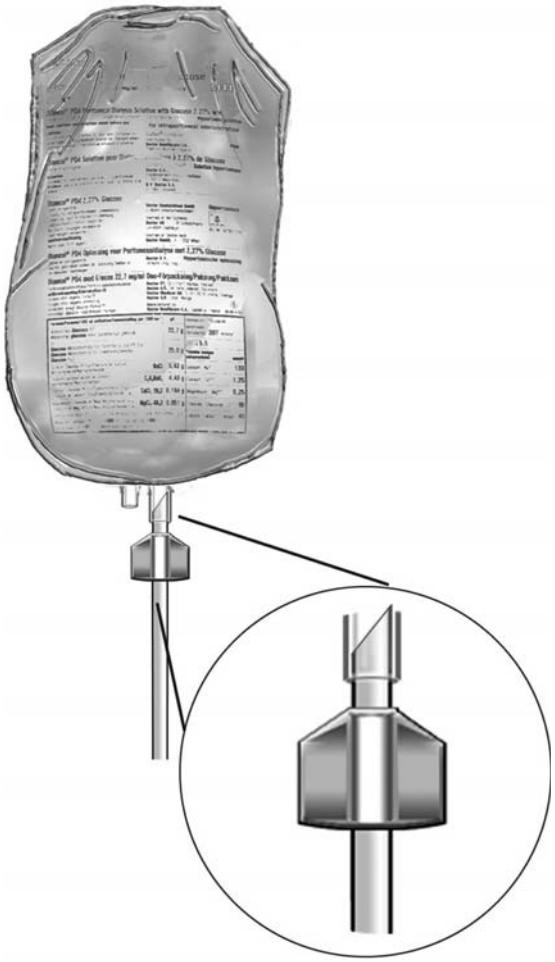

Fig. 10.8 A spike connector

between exchanges only the connector remained attached to the catheter. These two connectors were sprayed with an antiseptic solution both before and after the connection [26].

The Freeline® was a Y-set system where instead of the use of a disinfectant, the extension was closed with a cap containing an iodine impregnated sponge [26].

Another variation was the ANDY® system (nondisconnecting system), where, after the bag exchange, the Y-set was closed with an irreversible clamp and remained attached to the catheter acting as a cap until the next exchange [27].

Disinfecting Devices

In the era of "wearable" systems, the use of devices that could sterilize connecting surfaces was tempting. Ultraviolet (UV) light sterilization as well as heat sterilization, achieved with either electrical resistance or microwaves, were tested.

In a large randomized study by Nolph et al. [28] the UV-flash® disinfecting device did not prove effective in reducing peritonitis rate The authors recommended its use in less-skilled patients experiencing technique problems. Higher peritonitis rates were found in patients using UV-assisted "wearable" systems compared to patients using disconnecting systems [16]. However, these devices could prove useful in patients with impaired dexterity or vision, according to a retrospective multicenter study from Japan [29]. In vitro studies supported the germicidal effectiveness of these devices [30], but the results of a subsequent study by the same investigators, who quantified bacterial removal in disconnecting (Y-set and double-bag) systems, attribute the safety of these systems to the protective action of the design of the fluid path flow and the "flush before fill" [21].

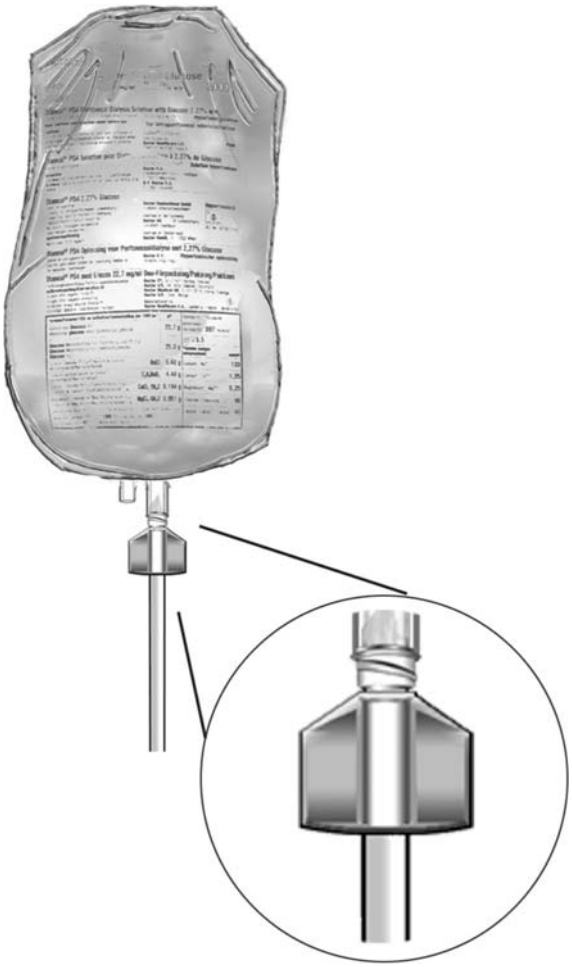

Fig. 10.9 A Luer lock connector

Other devices used heat for sterilizing the connection site. The Terumo Flame-Lock system used heating over a flame and ceramic connections with good results in reducing peritonitis rates [31]. The Fresenius Thermoclave device was used with the Safe Lock 5F® connector and gave good results, as well [32]. Low incidence of touch contamination and high patient acceptance was also reported with the use of the Sterile Connection Device, which used a heated blade to cut through parallel placed tubing of transfer set and fresh dialysate bag [33]. Another heat sealing device, although safe and simple, included the danger of serious burns for the patient or the caregiver and was very large and bulky [34]. Microwave moist-heat devices showed good in vitro results but did not prove practical [35, 36].

However, PD is considered a simple and patient friendly method without the complicated equipment of hemodialysis. All these devices added to the complexity and increased the cost of the method without substantial benefit for its safety and, therefore, their use has been mostly abandoned.

Internationally Available CAPD Delivery Systems

CAPD systems available internationally today, excluding locally manufactured and used ones, are, in alphabetical order of their manufacturers, the following (data provided by manufacturers after personal communication):

Baxter: The UltraBag® system is a double-bag system with a Luer lock connector. Different PD solutions are available (standard glucose, lactate/bicarbonate in dual-bag chambers, amino acid solutions, icodextrin solutions). Dialysate containers are made of PVC. Moreover, a special device for assisting patients during the bag connection (EZ-AIDE®) and a disinfecting device using UV light (UV flash® germicidal exchange device) are also available.

Bieffe: The Delta 4 system is a double-bag system with a Luer lock connector and a catheter extension cap containing povidone iodine. The dialysate container is made of Clear Flex®. The Clear Flex® has three layers. Starting from the outer layer these are made of polypropylene, polyamide, and polyethylene.

Fresenius AG: Stay-safe® and ANDY-disc® are both double-bag systems incorporating a special connector, the disc. After the initial connection of the disc to the extension set, all exchange phases are performed by turning the knob of the disc. At the end of the exchange an automatically introduced pin seals the lumen of the catheter extension. The tip of the extension is protected with a disinfectant-containing cap. Stay-safe® is the newer system of the two, offering more solution options (standard glucose, bicarbonate solutions, and dual chamber bags). The dialysate container is made of Biofine®, while the ANDY-disc® system uses PVC containers. Biofine® is made of polymers constructed exclusively from hydrogen and carbon atoms, the polyolenes.

Gambro: The Gambrosol® trio system is a double-bag system incorporating a special three-barrier connector and a prefilled tubing. The PVC containers have three compartments. An iodine containing cap is used for closing the catheter extension set.

Delivery Systems and Peritonitis

From the literature available so far, it becomes clear that disconnecting (Y-set and double-bag) systems are associated with lower peritonitis rates, compared to "standard" systems. All but one randomized controlled trial (RCT) or quasi-RCT comparing Y-set delivery systems to the "standard" systems showed that the number of CAPD patients who experienced at least one episode of peritonitis was significantly less for patients using the Y-set [37–43]. The exception was a study by Cheng et al. where this difference did not reach a statistically significant level ($p = 0.08$) [17]. All studies showed a significant improvement in peritonitis rates (episodes per patient-months) in favor of the disconnecting systems. These results are supported by a number of retrospective or observational studies [15, 44–47]. The length of the branches of the Y-set system, in one study, was not related to the incidence of peritonitis [48].

Three controlled studies where the "standard" system was compared to the double-bag systems showed a significantly reduced incidence of peritonitis with the latter systems [43, 49, 50]. Moreover, five controlled studies [43, 49, 51–54], where the two newer methods, that is, the Y-set and the double-bag systems were compared, consistently reported greater numbers of months per episode of peritonitis with the latter system. The superiority of Y-set or double-bag systems over "standard" systems and of double-bag over Y-set systems was confirmed by two meta-analyses of RCTs [55, 56].

Finally, two RCTs compared two double-bag systems: Stay-Safe® with UltraBag® and Andy-Disc® with Ultra-Bag®. The first study concluded that the two systems had similar incidences of peritonitis and exit-site infections [57]. The second study showed a trend towards greater peritonitis risk on the Andy-Disc® arm [58].

The Italian group that first described the Y-set reported a very low peritonitis rate (as low as one episode every 63 patient-months) [48]. Although such impressive results were not verified by others, a much improved peritonitis rate of one episode every 21–28 months was found in randomized studies comparing the new disconnecting systems with the "standard" [40, 50, 59]. Today, peritonitis rates are around one episode every 30 patient-months [60].

The routes through which an infectious agent can enter the peritoneal cavity and cause peritonitis are transluminal (touch contamination), periluminal (around the catheter), transmural (through the intestinal wall), hematogenous, and ascending (vaginal) [61]. The use of disconnecting systems led to a significantly lower danger of touch contamination. This is supported by the fact that the reduction observed in peritonitis rates after the introduction of disconnecting systems is mainly attributed to the reduction of infections with skin-related micro-organisms, like *Staphylococcus epidermidis*, while infections caused by *Staphylococcus aureus* or *Pseudomonas* species remained unchanged [40, 47, 49, 50, 62].

Delivery Systems and Exit-Site Infection

Two retrospective studies demonstrated a better exit-site infection rate in patients either on a Y-set [47] or a double-bag system [63], compared with patients on the "standard" system. However, in almost all randomized prospective controlled studies, the incidence of exit-site or tunnel infection is not related with the type of delivery system used. In particular, four studies comparing the Y-set with the "standard" system [17, 40–42], two studies comparing the double-bag with the Y-set [53, 54], and one study comparing a double-bag system with a "standard" one [50] demonstrated no significant difference in the rates of exit-site or tunnel infections. Similar results were published by Burkart et al. in two prospective, nonrandomized trials for Y-set versus "standard" systems [59, 64]. Only the study by

Kiernan et al. showed a trend towards lower exit site infection rate in patients using double-bag system compared with those using a Y-set (one episode per 12.5 patient months versus one episode per 28.5 patient months, respectively), but, again, the difference did not reach statistically significant levels [52]. Another RCT showed similar exit-site infection rates with two different double-bag systems (Stay-safe® and Ultrabag®) [57].

Delivery Systems and Ease of Use

Ballocchi et al. concluded that a double-bag system was rated as easy to use by the majority of their patients [65]. In a randomized study comparing double-bag systems versus Y-set systems, the former were considered more convenient and easier to handle [54], while the same group failed to find any differences in patients' acceptance between two different double-bag systems, at least after the first introductory month [57].

Delivery Systems and Technique Survival

It is difficult to assess the impact of a particular delivery system on technique survival, since so many other factors like ultrafiltration failure, peritonitis, catheter malfunction, etc., could play a decisive role. From the limited literature available, Tarchini et al. showed that the use of Y-set reduced the number of dropouts from the method, mainly due to the reduction in peritonitis rate [66], results that were confirmed by Port et al. in U.S. patients [46]. In another study, no difference in technique survival was found between patients using the "O" system and the "standard" system [17]. Finally, in a recent study comparing two double-bag systems, Wong et al. also showed no difference regarding technique survival [58].

Cost Effectiveness of Delivery Systems

Cost is a major concern for health systems, the cost of providing dialysis being a financial burden for insurance organizations, governments, and patients. Li et al. found that the extra cost required for the Y-system could be offset by other expenses required for infection-related morbidity of patients on the standard system [42]. In a Canadian study, Dasgupta et al. showed that the more expensive double-bag system resulted in significant savings due to reduction in peritonitis episodes and hospitalization rates compared to Y-sets [67]. Two randomized prospective trials proved that double-bag systems were more cost effective, compared with single-bag systems [43, 53].

CAPD Delivery Systems in Children

The data concerning the impact of delivery systems in children on PD are very limited. Some studies included children but made no special reference to this age group [41, 58, 59]. One retrospective study in children undergoing CAPD manifested a significantly lower peritonitis rate by the use of disconnecting (O- or Y-set) systems, compared with a nondisconnecting "standard" system [68]. Today, most children are on automated peritoneal dialysis (APD), a method more suitable to their lifestyle and special needs.

Comparison of CAPD Delivery Systems with APD

Automated PD machines (cyclers) are outside the scope of this chapter. However, the connections described here are also used for connecting the catheter extension with the tubing of the dialysate containing bags of a cycler.

In two studies where disconnecting systems had a lower peritonitis rate, as compared to "standard" ones, the former group included 259 APD patients out of a total of 968 patients on disconnecting systems [64, 69]. Comparisons of infectious complications between APD (by design a disconnecting system) and CAPD disconnecting (Y-set and Double-bag) systems are limited. In a randomized prospective study by de Fijter et al., APD patients had improved peritonitis rates but similar exit-site infection rates to patients on Y-set CAPD [70]. Another randomized study in a small number of patients (17 in each group) by Bro et al. failed to confirm these results [71]. In a nonrandomized prospective study from a Spanish center, APD resulted in lower peritonitis rate and similar exit-site infection rate,

compared with a Y-set CAPD system [72]. Retrospective or observational studies gave conflicting results. Two studies supported a lower incidence of peritonitis in CAPD patients using double-bag systems versus patients on APD [73, 74], while another found the two methods equal [75]. Finally, a study by Huang et al. showed a trend (with marginal statistical significance) towards lower peritonitis rates in APD patients [76].

Guidelines and Recommendations

Recommendations regarding PD delivery systems or connectology are made by only some of the guidelines published in the English language. In alphabetical order, these are:

British Renal Association [77]: *The use of disconnect systems should be standard unless clinically contraindicated (Evidence level A).*

Caring for Australians with Renal Impairment [78]: *Disconnect systems of CAPD result in lower rates of peritonitis than standard systems ("spike" or Luer lock) and the standard system should no longer be used (Evidence level A). Twin bag systems have lower rates of peritonitis than Y-disconnect systems and are recommended as the preferred CAPD technique (Evidence level A).*

European Best Practice Guidelines [79]: *Double-bag systems should be preferred, because they are more efficient in preventing peritonitis in CAPD patients. If double-bag systems are not available, any alternative Y-set system prevents peritonitis more effectively than any spike system (Evidence level A). Disinfecting devices have not demonstrated any significant reduction of peritonitis rates obtained by double-bag or Y-set systems (Evidence level A).*

International Society of Peritoneal Dialysis Guidelines [25]: *Spiking of dialysis bags is a high risk procedure for contamination of the system. "Flush before fill" reduces the risk of contamination (Evidence).*

The **Kidney Disease Outcomes Quality Initiative** [80] and the **Canadian Society of Nephrology** [81] have made no recommendations in their guidelines on the matter of PD connectology.

Glossary

Automated PD machine An electrical appliance specifically designed to perform peritoneal dialysis automatically, also known as a "cycler."

***Biofine*®** A material made up by polyolenes, which are polymers constructed from hydrogen and carbon atoms.

Catheter Refers to the permanent peritoneal catheter.

Catheter extension A piece of tubing connecting the catheter to the PD delivery system.

Clear flex® A registered trademark of Bieffe-Baxter. The Clear-Flex® bag is a three-layer laminate. Its inner layer is composed of polyethylene, the middle of polyamide, and the outer of polypropylene.

Connecting device A device of different designs (exclusively specific for each PD delivery system) used for the connection of the catheter or its extension to the delivery system. Synonym to connector.

Connector See connecting device

Cycler See automated PD machine

Dialysate The peritoneal dialysis solution.

Dialysate container The bag containing the dialysate, also known as "peritoneal dialysis bag."

Dialysate fresh The unused dialysate.

Dialysatespent The used dialysate, after its dwell into the peritoneal cavity.

Disconnecting system Also known as disconnect system, refers to those CAPD delivery systems that are disconnected from the patient between bag exchanges.

Disinfectant Any solution used for the disinfection of any connection site of a PD delivery system.

Disinfecting device A device of different designs using various sources of energy (heat, UV light) in order to disinfect the connection site of a PD delivery system.

Double-bag system A CAPD delivery system where both bags (the one containing the fresh dialysate and the empty drainage bag) are already connected to the Y-shaped tubing by the manufacturer.

Drain The action of outflow of the spent dialysate from the peritoneal cavity.

Drainage bag The bag into which the spent dialysate is drained.

Dwell The period during which the dialysate remains in the peritoneal cavity.

Fill The action of the inflow of the fresh dialysate from its container into the peritoneal cavity.

Flush before fill The action of flushing the tubing with a small volume (~100 mL) of fresh dialysate drained from the new bag directly into the drainage bag, followed by the fill.

Luer lock A type of tubing connector with threaded fittings for a secure connection and added leverage for seal disconnect. The concept for these connectors and adapters was developed by a German instrument maker whose name, Luer, still defines this unique design.

Nondisconnecting system Also known as nondisconnect system, refers to those CAPD delivery systems where the dialysate bag remains connected to the patient between bag exchanges.

O-set A variant of the original Y-set, named from the shape it takes when the two free limbs are connected to each other during the dwell phase.

Peritoneal dialysis bag See dialysate container

Peritoneal dialysis connectology A conventional term referring to the various systems of transfer sets, connecting devices, containers, adapters, etc., that are used during the process of PD.

Peritoneal dialysis delivery system A system incorporating all necessary parts and actions required for the process of bag exchange in peritoneal dialysis. Synonym to "peritoneal dialysis system."

Peritoneal dialysis solution See dialysate

Peritoneal dialysis system Synonym to "peritoneal dialysis delivery system."

PVC Polyvinyl chloride.

Spike A rigid, pointed, hollow plastic tube.

Standard PD system The nondisconecting or wearable PD system.

Titanium adaptor The Luer lock adaptor, made of titanium, connecting the catheter to its extension.

Transfer set The tubing connecting the catheter to the dialysate bag in the nondisconnecting system.

T-set A variant of the double bag system, which consists of a catheter extension equipped with a very short lateral limb, through which, at the end of the exchange, before the disconnection of the bag, a disinfectant is injected, filling the catheter extension.

Twin-bag system Synonym to "double bag."

Y-set A Y-shaped connecting tube. During the bag exchange procedure the main (vertical) limb of the Y-shaped connecting tube is connected to the catheter extension, while the second limb is connected to an empty (drainage) bag and the third one to a new bag containing the fresh dialysate.

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