

EXTENSION SET FOR DRUG DELIVERY

This invention relates to an extension set for drug delivery. More particularly, this invention relates to a method of administering a drug.

As is known, various types of systems are known for feeding fluids into a patient intravenously. Various systems are also known wherein drugs or the like can be added to an intravenous solution which is being administered to a patient. For example, it has been known to connect an infusion tube to a Y-connection having branches which are, in turn, connected to two separate tubes, one of which leads to a source of intravenous solution while the other leads to a drug source. In these cases, a drug can be added from time-to-time by being mixed in with the intravenous solution. Examples of such systems are described in U.S. Pat. Nos. 2,866,457; 4,105,029; 4,114,617; and 4,335,717.

Other similar systems have also been known wherein a drug can be administered via a sealed branch line joined to a conduit by a rubber tube, such as described in U.S. Pat. No. 2,656,835. In this case, use is made of a hypodermic syringe to pierce a self-sealing means at the end of the branch tube in order to be able to introduce a drug.

Several problems have, however, been associated with systems of the above types of drug administration. For example, several publications have indicated that certain drugs adsorb to glass, to plastic infusion systems or to filtration materials, thus potentially decreasing the amount of drug ultimately delivered to a patient. Particular problems have also been noted with such types of systems in the administration of drugs to small pediatric patients in that the amount of time for completion of a drug infusion, once begun, is frequently unduly prolonged and also not consistent with the time predicted to be required to deliver the prescribed drug dosage. In this regard, reference is made to Gould and Roberts, *The Journal of Pediatrics*, September 1979, pages 465-471; Leff and Roberts, *The Journal of Pediatrics*, April 1981, pages 631-635; and Roberts, "Intravenous Administration of Medication in Pediatric Patients: Problems and Solutions", *Pediatric Clinics of North America*, February 1981, pages 23-24.

It is also known that when a drug is introduced via an intravenous line with such heretofore known systems, that the administration of the drug follows a "peak and valley" pattern with a pronounced "spike" at some point during administration. That is, when the drug is first introduced into a parallel line or shunt connection, there is a "hold-up" of the drug before reaching the intravenous fluid and thereafter, there is a varying dilution of the drug while passing with the intravenous fluid into the patient. As a result, there may be some initial spike in the administration of the drug followed by a tailing off of the actual amounts being infused, and the intended dosage and the intended rate and time of the dosage may not be achieved.

Aside from the above problems, it has also been known that the infusion of a small amount of air into a patient may be quite damaging if not fatal. This is particularly so in the case of small pediatric patients. Hence, there is a need to eliminate any air in an administration set for infusing liquids and drugs into a patient. In the past, it has been necessary for a nurse or other qualified person to manipulate the administration set in order to prime the set while expelling any air therefrom. In this

regard, the air is generally detected by the appearance of small bubbles. In any event, cumbersome procedures are frequently required in order to insure that all the air has been eliminated from the administration set.

Accordingly, it is an object of this invention to provide a relatively simple technique for intravenously delivering drugs to a patient.

It is another object of the invention to accurately inject a drug into a patient in proper dosages.

It is another object of the invention to provide a relatively simple extension set which can be self-priming.

It is another object of the invention to provide an extension set which insures delivery of a proper drug dosage to a patient.

It is another object of the invention to deliver a drug intravenously to a patient accurately in terms of dosage, rate and time.

Briefly, the invention provides an extension set for delivering a drug to a patient which comprises means defining at least two lumen and a common connector. In this regard, each lumen has an open distal end and a terminal end, with one lumen sized to convey an intravenous fluid to the terminal end thereof while the other lumen is sized to convey a drug to the terminal end thereof. The connector is constructed to receive the terminal end of each lumen and has means at one end for connecting to a catheter in order to deliver the intravenous fluid and the drug thereto.

In one embodiment, the connector is provided with an interfacing chamber of relatively short dimensions for receiving each terminal end of the lumen in order to interface the conveyed drug with the intravenous fluid immediately prior to passage into the catheter.

In another embodiment, the connector is provided with a pair of sockets for individually receiving two lumen and a partition wall which extends between the sockets to the means at the end of the connector for connecting to the catheter.

In the case where the extension set is to be used for small pediatric patients, the two lumen are each of micro-size with an internal diameter of 0.020 inches.

In still other embodiments, the means defining the lumen is in the form of two tubes each of which defines a lumen and with one tube disposed within the other tube. In addition, the innermost tube may be movably mounted in the outer tube and slidably mounted in the connector in order to project from the connector. In this embodiment, the inner tube can be used to deliver a drug directly into a vein of a patient.

In order to provide for self-priming of the extension set, the drug conveying lumen is provided with a hydrophilic filter at the distal end so as to prevent passage of air into the tube. In addition, a hydrophobic filter may also be removably attached at the distal end in order to prevent liquid from passing out of or into the drug conveying lumen when not in use.

The extension set may be connected via the connector to any suitable catheter which can be implanted into a patient, such as a small pediatric patient, an adult, or an animal. In addition, each of the lumen of the set may be respectively connected to a means for delivering an intravenous fluid or a means for delivering a drug. In this regard, a double-tube lumen can be used to define the two lumen wherein the double-tube lumen can be separated along a common joint to accommodate to different locations of the fluid source and the drug