ABSTRACT

The invention comprises an inner and outer tube provided on their facing surfaces with canted projections which, in ratchet-like fashion, permit movement in one direction but not the other. The outer tube may be sutured to the skin and, in the event of distention of the abdomen due to gas, the outer tube will merely slide over the inner tube; in the absence of the outer tube, such distention would serve to pull the tube out of the organ to which it extends.

4 Claims, 4 Drawing Figures
DRAINAGE SYSTEM FOR BODY CAVITIES

The present invention relates to a system for permitting flow of fluid between a body cavity and a location outside the body. As an adjunct to surgical procedures, tubes of different types may be placed into various internal viscera and brought out to the surface of the body. For example, one end of the so-called "T" tube may be placed in the common bile duct and the other end brought out through the abdominal wall as a drainage duct for the bile, or as a removable stent in repair of the duct. One of the dangers associated with the use of these tubes is its inadvertent dislodgement from the viscera with the consequent spilling of visceral contents, e.g., bile, into the peritoneal cavity. This dislodgement may occur in two ways:

1. By pulling on the external part of the tube; or
2. If there is distention of the bowels with gas or fluid or the development of an intraperitoneal fluid collection, the abdominal wall may be "ballooned" out, thereby increasing the distance between the abdominal wall and a fixed viscus, e.g., the bile duct. If there is a tube running between these two points which is fixed to the abdominal wall, the distention may cause it to become dislodged from the viscus.

Current methods of dealing with these tubes involves disregarding one or the other of these dangers. In one case the tube is fixed tightly at the skin level by either piercing a tab on the tube with a suture which is tied to the skin, or by tying the suture around the tube. However, this allows the tube to become dislodged by the "distention mechanism." Another way to deal with the tube is not to fix it at the skin level. This would allow the abdomen to distort without dislodging the tube. There would, as a result, be a greater length of tube intraperitoneally. A tube handled in this way may easily be pulled out accidentally.

It is accordingly an object of the present invention to provide a system which will permit such fluid drainage without the problems associated with prior devices, viz., accidental dislodgement.

This and other objects and advantages are realized in accordance with the invention wherein there is provided a system comprising closely fitting inner and outer tubes. At least one of the tubes on its face directed toward the other tube is provided with a plurality of projections extending in one direction so that by a ratchet-type action they permit relatable movement between said tubes in one direction and resist relative movement in the opposite direction.

The invention will now be described more fully with reference to the accompanying drawing, wherein:

FIG. 1 is a longitudinal section through a short length of the outer tube;
FIG. 2 is a perspective view of a short length of the inner tube;
FIG. 3 is a longitudinal section showing the interaction between the tubes of FIGS. 1 and 2 in operative relationship; and
FIG. 4 is a perspective view showing an alternate form of inner tube.

Referring now more particularly to the drawing, in FIG. 1 there is shown an outer tube 10 comprising a generally cylindrical wall 12 provided with a plurality of projections 14 each of which is an annular ring integral with the wall. Each projection 14 in cross section is essentially triangular with an obtuse angle adjacent its joiner to the wall 12 which is responsible for the tapered forward end being canted in the downwardly direction, which will be toward the body.

In FIG. 2 there is shown an inner tube 16 comprising a generally cylindrical wall 18 provided with a plurality of projections 20 which are generally similar in shape and size with projections 14 of outer tube 10.

As can be seen in FIG. 3, when the inner tube is positioned inside the outer tube, it is possible to move the outer tube upwardly or the inner tube downwardly but movements in the opposite directions are resisted by the interengagement of the projections 14 and 20 in ratchet fashion.

In operation, outer tube 10 may be inserted through the body opening and held in fixed position as by a suture or tape. The inner tube projects through the outer tube, extending to the organ which is to be drained, for example; the forward ends of the tubes may be coextensive or the forward end of the inner tube may project beyond the forward end of the outer tube; there is little point in having the forward end of the outer tube project beyond the inner tube although this is permissible. In the event the abdominal wall is distended, due to gas buildup or the like, this will of course carry the outer tube therewith since it is connected as by a suture. However, the viscera which holds the forward end of the inner tube will mildly resist the inner tube moving, and the outer tube will accordingly slip readily over the inner tube. In this fashion there will still be a tubular connection between the viscera and outside the body whereas, had there been no inner tube, the tube would have been withdrawn from the viscera upon movement of the abdominal wall. In generally similar fashion an external pull on the outer tube 10 would merely cause it to slip over the inner tube 16 but would not remove the inner tube from the viscera; an external pull on the inner tube would not permit its removal from the outer tube, such removal being opposed by the mating projections 14 and 20.

In FIG. 4 there is shown an alternative embodiment wherein the inner tube comprises a smooth walled tubular cylinder 22 and one or more strips 24 concave on their insides and provided with projections 26 similar in cross section to projections 20. The strips 24 may be secured to the outside of tube 22 as by an adhesive backing, by an externally applied adhesive or solvent or by thermal fusion.

In practice it is possible for only one of the inner and outer tubes 10 and 16 to be provided with canted projections, the other member being relatively smooth or provided with non-canted projections such as sinusoidal ridges. The relative movement would then be opposed merely by the one set of projections. It is also possible that the projections, whether on one or both tubes, do not fully surround the tube, i.e., they are not fully annular.

The tubes may be made by casting in a suitable mold. Alternatively they may be continuously extruded through a die of appropriate shape. The projections can be formed either after the tube is fabricated as by insertion of a heated mandrel which is moved in suitable fashion or they can be formed as the tube is extruded by appropriate movement of a member at the outlet of the extrusion die.

The projections need not be triangular in cross section but could be trapezoidal, acute, or of other shape, provided they are canted in one direction so as to permit only one-way movement. The longitudinal spacing between projections may vary along each tube and/or the longitudinal spacing between projections on the inner tube may be different from that on the outer tube without untoward effect.

The tubes should be composed of flexible material and they are preferably transparent, although this is not essential. It is obviously necessary that the material must be physiologically compatible. This applies not only to the basic polymer but also to any plasticizers, antioxidants, adjuvants, pigments, or like. A suitable material comprises silicone rubber, polyethylene, and the like.

While the tubes are preferably used in conjunction, as noted either tube may be used with a smooth wall mate or it is possible to use inner tube 16 alone, replacing the outer tube by a loop or suture of material fixed to the skin. In such fashion one of projections 20 will engage the suture loop to prevent relative movement in one direction.

It will be appreciated that the instant specification and examples are set forth by way of illustration and not limitation, and that various modifications and changes may be made without departing from the spirit and scope of the present invention.

What is claimed is:

1. A surgical drainage device for permitting flow of fluid between a living body cavity and a location outside the body, comprising an outer tube having a drainage bore throughout the length thereof, an inner tube removably disposed within...
said bore and in close fitting relationship therewith and a plurality of projections, said projections being located on one of said tubes and directed toward the other of said tubes, said projections being further of such radial extent as positively to engage means of said other of said tubes to permit relative longitudinal movement between said tubes in one direction and to resist movement in the opposition direction, whereby when said device is operative with one of said tubes extending into said body cavity said drainage from said body cavity can be accomplished.

2. A device according to claim 1, wherein both of said tubes are provided with such projections, the projections of one tube extending oppositely to those of the other tube and forming a ratchet-action therewith.

3. A device according to claim 2, wherein each of said projections is substantially triangular with an obtuse angle adjacent the connection with its tube and with an acute angle at the forward end of said projection.

4. A device according to claim 3, wherein each of said projections is an annular ring.

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