

[54] VASCULAR TOURNIQUET

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[57] ABSTRACT

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A vascular tourniquet or snare for use in a surgical procedure where it is desired to limit or restrict flow through a body vessel or to secure a tube within such vessel. The tourniquet or snare consists of an elongate sheath through which a rigid retractor extends. A tape or cord wrapped about the vessel is withdrawn through the sheath by the retractor and secured thereto by a plug inserted in the proximal end of the sheath.

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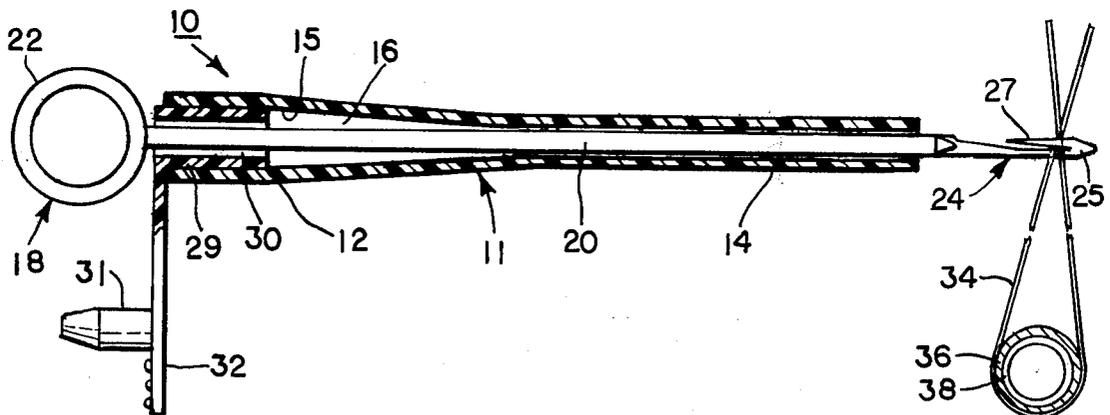
[58] Field of Search 128/325, 326, 327, 349;
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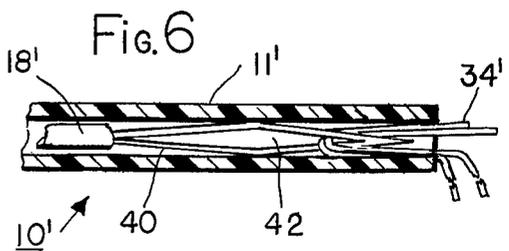
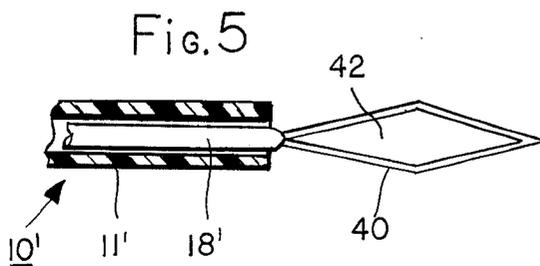
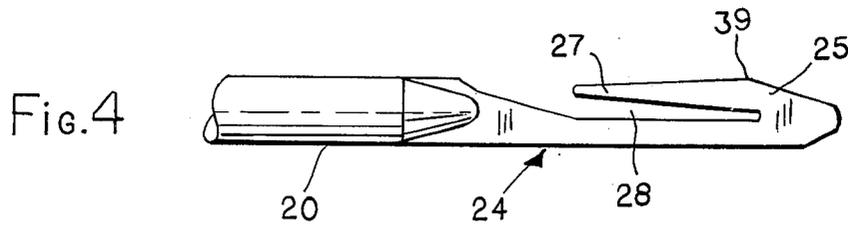
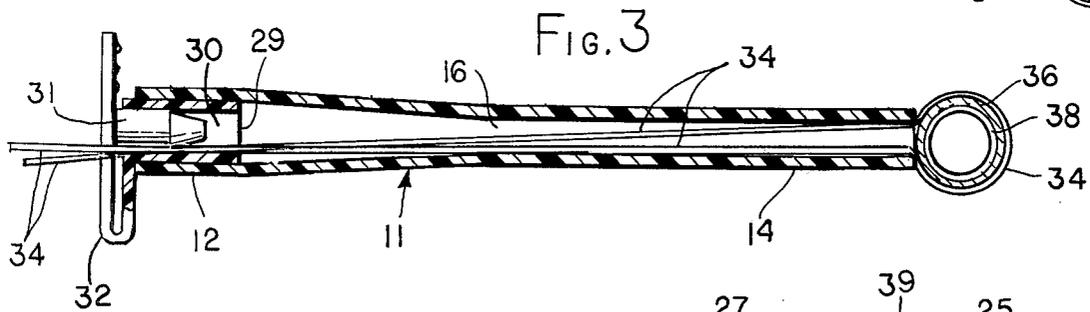
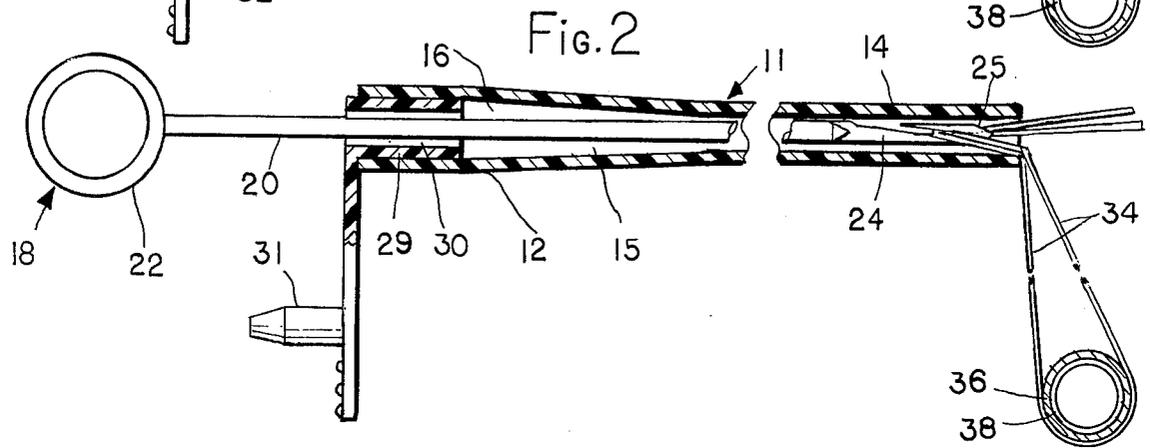
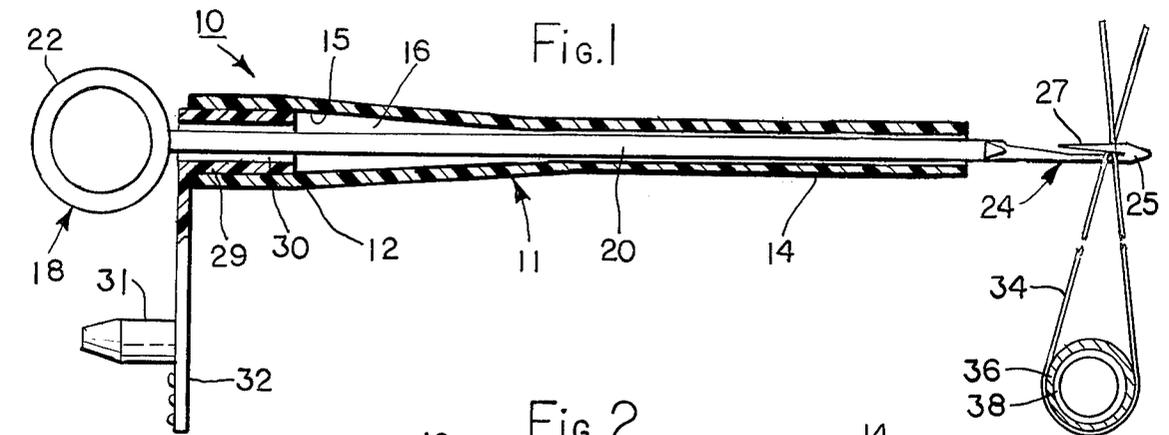
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12 Claims, 6 Drawing Figures





VASCULAR TOURNIQUET

BACKGROUND OF THE INVENTION

This invention relates to a vascular tourniquet or snare, and more particularly to a disposable device of this nature which substantially reduces the clutter normally occurring in the surgical field during certain operative procedures.

During certain surgical procedures it is customary to insert a catheter or other medical tube into the lumen of a vein or artery for various purposes. For example, in open heart surgery it is necessary to provide an artificial means whereby the breathing functions of the lungs and pumping functions of the heart can be assured during the period that the heart is open. Thus, the heart and lungs must be bypassed by diverting the venous blood returning from the body to the right atrium into a heart-lung machine and pumping the blood oxygenated by the machine back into the aorta, either through one of its branches or through the aorta itself. For this purpose, vena caval catheters are inserted into the superior and inferior vena cavae. In the past, it has been common practice to prevent leakage of blood at the entry site by encircling the vessel with a snare, tourniquet or suture. For example, a "purse-string" suture or a cord "shod" may be used, the latter consisting of a rubber tube through which a length of umbilical tape is passed after encircling the vessel. Once the tape is passed through the tube, an external clamp such as hemostat is applied to the tube to secure the tape in position therein.

The use of such prior art clamping devices provide considerable clutter in the operative field principally due to the clamp used to secure the umbilical tape within the rubber tube. In certain operative procedures a relatively large number of such devices must be used, thereby unduly limiting the surgeon's access to the operative site.

Examples of vascular tourniquets which have been designed to overcome these and other problems in the use of conventional devices are illustrated in U.S. Pat. Nos. 3,043,308 and 3,507,270. As will be readily observed, however, the devices illustrated by these patents are relatively expensive to manufacture, and lack the simplicity and ease of use which characterize the present invention.

SUMMARY OF THE INVENTION

Accordingly, among the several objects of the present invention may be noted the provision of a vascular tourniquet which substantially reduces clutter at the operative site; the provision of such a device which is easily manipulated for use but which securely holds a tube or catheter within a body vessel or restricts or prohibits flow through such vessel; and the provision of such a device which is characterized by low cost and may be disposed of after use with a single patient.

In general, vascular tourniquet constructed in accordance with the present invention comprises an elongate tubular sheath having proximal and distal ends. An elongate retractor extends through the lumen of the sheath and beyond both ends thereof, the retractor having a handle at its proximal end and a hook at its distal end. A cord or other similar device is engaged by the hook after being positioned about a body vessel for drawing the ends of the cord through the lumen of the sheath and out its proximal end upon withdrawal of the

retractor from the sheath lumen. A plug is frictionally received within the proximal end of the sheath to secure the cord against movement with respect to the sheath by binding the cord between the sheath and the plug.

These and other objects and features will be apparent hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal view, partly in section, of the vascular tourniquet of this invention with a body vessel;

FIG. 2 is a view similar to FIG. 1 but with the retractor of the tourniquet in a changed position;

FIG. 3 is a view similar to FIG. 1 but with the tourniquet in position of use;

FIG. 4 is a fragmentary view showing the distal end of the retractor of the tourniquet of FIG. 1;

FIG. 5 is a fragmentary view, partly in section, of an alternate embodiment of the invention; and

FIG. 6 is a view similar to FIG. 5 but with the retractor shown partially withdrawn.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. 1-4, the present vascular tourniquet is indicated generally at 10. While the vascular tourniquet will be described for use in securing a catheter within a body vessel, such as vein or artery, it will be understood that the invention can also be used for constricting a vessel, such as a blood vessel, urinary tract duct, etc.

The vascular tourniquet 10 is shown to comprise an elongate tubular sheath 11 having a proximal end 12 and a distal end 14. The sheath 11, as illustrated, tapers slightly substantially from its proximal to its distal ends although a cylindrical sheath may also be used. The inner wall 15 of the sheath 11 defines a lumen 16 extending throughout the length of the sheath. A relatively rigid elongate retractor 18 is telescopically received within the lumen 16 of the sheath 11, the retractor comprising an elongate rod 20 having an integral handle 22 at its proximal end and an integral hook 24 at its distal end. As illustrated in the drawings, the retractor handle 22 comprises a circular finger ring, and the hook 24, as seen in greater detail in FIG. 4, comprises an open loop 25 having a proximally extending tip 27. As will be described more fully hereinafter, the tip 27 of the hook 24 defines an open eyelet or opening 28 for receiving a cord or tape.

A tubular collar 29 is secured within the lumen 16 of sheath 11 at its proximal end 12. Collar 29 has a bore 30 and is secured to the inner wall 15 of the sheath by any suitable means, such as frictional engagement, a suitable adhesive or solvent bonding.

A plug 31 is connected to the proximal end of the collar 29 by an integral tether or strap 32 which is formed of sufficiently flexible material so that the plug may be readily inserted within the bore 30 of collar 29, as seen in FIG. 3. The outer diameter of plug 31 and inner diameter of bore 30 are sized for tight frictional engagement of the plug within the bore.

A length of umbilical cord or tape 34 is looped about a body vessel 36 having a catheter or tube 38 therein. It should be understood, however, that any suitable li-

gating material may be used in lieu of umbilical cord to tape 34, for example, a suture type ligature or other sterile string or cord may be used depending upon the particular use of the tourniquet.

To use the present vascular tourniquet, for example in an operative procedure wherein it is desired to secure the catheter 38 within body vessel 36, the cord 34 is looped about the vessel 36 at the desired location and the free ends of the cord 34 are grasped within the loop 25 of the hook 24, as illustrated in FIG. 1. The sheath 11 is then held by the user and the retractor 18 is withdrawn through the lumen of the sheath by grasping the finger hook 22 and moving the retractor proximally relative to the sheath. This procedure, as illustrated in FIG. 2, draws the free ends of the cord 34 through the lumen of the sheath until the free ends extend beyond its proximal end 12. The retractor 18 may then be discarded.

As will be noted, the tip 27 of the hook 24 has an upper portion which extends proximally and is inclined downwardly toward the axis of the retractor rod 20. The transverse dimension or height of the hook at the tip 27 is less than the diameter of the main cylindrical portion of the rod 20, so that the hook, with the cord ends therein, may easily pass through the lumen 16 and bore 30 of the sheath and collar without snagging. It will also be noted that the opening 28 tapers from the open proximal end thereof to its closed distal end to permit easy lateral insertion of the cord 34 into the opening 28 and to wedge the cord ends into tight frictional engagement with the hook 25. The right end of the loop 25, as viewed in FIG. 4, is generally tapered to provide easy insertion into the sheath 11. The loop has a maximum height or transverse dimension at a portion indicated at 39 which has a height substantially equal to the diameter of the main portion of member 20 and which serves as a guide for the hook when moving in the sheath.

The free ends of the cord 34 that now extend beyond the proximal end 12 are grasped by one hand of the user while the sheath 11 is held by the other hand, and tension is applied to the cord 34 until the looped end of the cord exerts the desired degree of pressure about vessel 36. When this is obtained, the sheath is compressed to hold the free ends of the cord against slippage and the plug 31 is inserted within the bore 30 of collar 20 to securely bind the cord between the inner wall of the bore 30 and the outer surface of the plug 31, as shown in FIG. 3. The vascular tourniquet may then be released and will securely retain the tension applied by the cord 34 about the vessel 36. To remove the tourniquet, the plug 31 is merely removed from bore 30 and the sheath 11 withdrawn proximally from the cord and vessel.

As illustrated in the modified embodiment of FIGS. 5 and 6, a tourniquet 10' includes a tubular sheath 11' which is identical to sheath 11 of FIG. 1, and a retractor 18' which is similar to retractor 18 except that the hook at the distal end of retractor 18' comprises a radially flexible loop or eyelet 40. As shown, the loop 40 is continuous or closed so that the free ends of cord, such as cord 34', are threaded through the central opening in the loop, indicated at 42, to withdraw the cord ends through the lumen of sheath 11' upon withdrawal of the retractor 18'. As is apparent from FIG. 5, the free unrestrained dimension of the loop 40 is greater than the inner diameter of the lumen of sheath

11', but as the retractor is withdrawn through the sheath 11', the loop 40 is caused to flex radially inwardly to assume a transverse dimension permitting passage thereof through the lumen with the cord frictionally held thereby, as is apparent from FIG. 6.

The sheaths 11 and 11' are preferably made from a resiliently flexible plastic material so that they are somewhat flexible or compressible generally in the axial direction whereby the cord is resiliently urged axially by the resiliency of the sheath when the tourniquet is applied to a vessel. In this way, any forces tending to move the sheath angularly relative to the vessel during application and use of the tourniquet are at least partially absorbed by the sheath thereby tending to avoid excess forces on the vessel. The sheath should, of course, be sufficiently rigid to avoid collapse when under the normal compressive forces encountered in use. Sheaths of polyvinyl chloride have provided good results.

The vascular tourniquet of the present invention may be readily made entirely from inexpensive synthetic plastic materials so as to be disposed of after a single use. For example, the sheath 11 may be extruded of polyvinyl chloride while the retractor rod may be injection molded of polypropylene. The plug 31 and collar 29, together with tether strap 32, may be injection molded of polyvinyl chloride.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results obtained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A vascular tourniquet comprising an elongate tubular sheath having proximal and distal ends, an elongate retractor extending through the lumen of said sheath and beyond both ends thereof, said retractor having a handle at its proximal end and a hook at its distal end, a cord or the like adapted to be positioned about a body vessel and engaged by said hook for drawing the ends of the cord through the lumen of the sheath and out its proximal end upon withdrawal of said retractor from said lumen, and a plug axially insertable from the exterior of said sheath into the proximal end of said sheath to secure the cord against axial movement with respect to said sheath.

2. The vascular tourniquet of claim 1 further comprising a tubular collar secured within the lumen of said sheath at its proximal end, said collar having a bore with an inner diameter generally corresponding to the outer diameter of said plug for frictionally receiving the same.

3. The vascular tourniquet of claim 2 further comprising an integral strap securing said plug to said collar.

4. The vascular tourniquet of claim 1 wherein said hook comprises a proximally directed open loop having a tip portion inclined toward the axis of said retractor.

5. The vascular tourniquet of claim 4 wherein said handle is a finger ring.

6. The vascular tourniquet of claim 4 further comprising a tubular collar secured within the lumen at the proximal end of said sheath, and an integral strap se-

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curing said plug to said collar, said collar having a bore with an inner diameter generally corresponding to the outer diameter of said plug for frictionally receiving the same.

7. The vascular tourniquet of claim 1 wherein said hook comprises a flexible loop integrally carried at the distal end of said retractor, said loop normally having a transverse dimension greater than the diameter of said lumen but being capable of flexing to a smaller dimension to pass through said lumen upon withdrawal of said retractor.

8. The vascular tourniquet of claim 7 further comprising a tubular collar secured within the lumen at the proximal end of said tube, and an integral strap securing said plug to said collar, said collar having a bore with an inner diameter generally corresponding to the outer diameter of said plug for receiving said cord and frictionally receiving said plug.

9. The vascular tourniquet of claim 1 wherein said hook comprises a loop at the distal end of said retractor, said loop defining an elongate eyelet open at its

6

proximal end and tapering toward its distal end for receiving the cord in wedged frictional engagement and having a tip at the open proximal end of said eyelet which is radially inward relative to the periphery of the main portion of said retractor to prevent snagging of the hook on the distal end of said sheath.

10. The vascular tourniquet of claim 9 wherein said loop is an integral part of said retractor and has a portion spaced distally of said tip which is substantially equal to the diameter of the main portion of said retractor.

11. The vascular tourniquet of claim 1 further including flexible plastic connection means connecting said plug to said sheath to allow axial insertion of said plug into the proximal end of said sheath to frictionally engage and hold said cord and to allow axial removal of said plug from the proximal end of said sheath.

12. The vascular tourniquet of claim 11 wherein said plug is of plastic material.

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