

## INTRAVASCULAR OCCLUDING CATHETER

## SUMMARY OF THE INVENTION AND STATE OF THE PRIOR ART

The present invention relates to an intravascular occluding catheter and a method of utilizing the same to penetrate and enter a vessel and occlude such vessel; and more particularly relates to a balloon type intravascular occluding catheter having a removable trocar with a vessel piercing tip thereon for permitting the formation of an incision in the vessel walls and entry of the catheter connected thereto past the balloon so that the balloon may be expanded to thereby internally clamp or otherwise occlude fluid flow in the vessel.

There are numerous catheters depicted in the prior art for use in surgery. One of the most famous of the catheters is the Fogarty catheter as illustrated in U.S. Pat. No. 3,435,826 which is utilized for embolectomies or removal of an embolus that has broken away from a thrombus. Another type of catheter depicted in the prior art is illustrated in U.S. Pat. No. 3,087,493 wherein the catheter is utilized as an endotracheal tube to maintain a free air way or breathing passage for the patient during surgical operations. Modifications and variations of catheter types are exhibited in such patents as U.S. Pat. No. 2,936,761 wherein the catheter is designed specifically for use in the urinary bladder, or in U.S. Pat. No. 3,547,119 wherein the catheter is in essence a cannula (a small tube for insertion into a duct or vessel) with a stylet which is slidably disposed therein and has a point thereon for making an incision in a vessel.

There are many instances in the human body where, in repairing vascular ruptures or removing blockages therein, it is necessary to stop blood flow in order to repair the rupture or remove the blockage in the vessel. Conventional practice is to clamp the vessel being repaired, at least at the higher pressure end, to keep the area to be repaired free of blood so that the repair may be made or blockage removed, while simultaneously preventing a loss of blood which would otherwise have to be replaced. When the vessel being clamped, for example, is in a relatively young person, the vessel is usually soft and pliable and there is little (in most instances) calcium formation in the vessel. However, in older people that have minor arterial diseases, or calcium formations within the artery, placing a clamp on the artery causes the calcium to break up. After the repair has been made and the clamp removed, the calcium tends to move in the artery in the direction of blood flow and may act as an occluding embolus, whose affect is dependent upon the place where it lodges. Additionally, as the arteries and veins become older they tend to become less pliable and the placement of a clamp thereon tends to create a crease in the vessel wall which causes weakening thereof, many times resulting in an increase in the original atheromatous process at that point.

Accordingly, it is desirable to provide an intravascular occluding device that will expand radially from within the vessel to thereby occlude flow in the vessel whether it be blood or any other body fluid, to thereby inhibit weakening of the vessel lining and thereby preventing the release of calcium and/or atheroma and the possible damage to the vessel wall by an external oc-

cluding clamp, as heretofore mentioned, while form fitting to the internal shape of the vessel.

Additionally, because operations which are performed to repair, for example, ruptured aortic aneurysms are usually conducted on an emergency basis, the implement being used to occlude the vessel should preferably be one which may enter the vessel and occlude as rapidly as possible so as to permit clearing of the ruptured area to facilitate repairs, and to effect rapid but noninjurious clamping of the vessel from at least its high pressure end.

In view of the above, it is a principal object of the invention to provide an intravascular occluding catheter which may rapidly and effectively be applied to stem fluid flow or isolate a region of the vessel which is to be surgically addressed.

Another object of the present invention is to provide a catheter of the balloon type which may rapidly make an incision in the wall of a vessel and enter therein to permit expansion of the balloon so as to occlude further passage of fluids.

Another object of the present invention is to provide a novel method of occluding a vessel with a catheter having an expansible balloon adjacent one end thereof and a vessel wall piercing tip thereon, including the steps of piercing the vessel wall with the tip, inserting the catheter into the vessel through the incision thus made, and expanding the balloon to thereby occlude flow in the vessel.

Yet another object of the present invention is to provide a method of intravascular occlusion utilizing a balloon-type catheter, as above set forth, which includes a trocar disposed in the catheter and having a vessel piercing tip on one end thereof, whereby after the balloon on the catheter has entered into the vessel and internally clamped the vessel to prevent further flow, removing the trocar will provide a passage for medication into the vessel, or permit fluid samples to be taken through the passage.

Yet another object of the present invention is to provide a novel intravascular occluding catheter having a pair of tubes, one for permitting the entry of fluid for expansion of the balloon and the other for entrance and egress of a trocar having an incising tip thereon.

Yet another object of the present invention is to provide a catheter which may be used in pairs or more to isolate a vessel section so as to permit entry of medication into the section so as to prevent contamination of surrounding areas when it is desired to surgically address the particular area isolated.

Other objects and a more complete understanding of the invention may be had by referring to the following specification and claims taken in conjunction with the accompanying drawings in which:

FIG. 1 is an enlarged fragmentary sectional view of a catheter constructed in accordance with the present invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view of a portion of the device illustrated in FIG. 1;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary sectional view of another embodiment of a catheter constructed in accordance with the present invention;