A New Idea for Venting Arterial Line Filters

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Introduction

The arterial line filter used in the extracorporeal circuit removes microbubbles and microparticles formed from platelets, red blood cells, and other debris due to cellular trauma during open-heart procedures. It has become a part of our extracorporeal circuit, and as we evaluate the different arterial line filters, we are bothered by two aspects: the splashing of vented blood into a reservoir, and extensive contact of blood to foreign surfaces when vented to a cardiotomy reservoir.

Materials and Methods

The manufacturer of one arterial line filter[1] suggests a sterile purge line be connected between the arterial filter's vent port and one of the low pressure oxygenator ports if a bubble oxygenator is used. The same manufacturer recommends connecting the end of the purge line to a vented cardiotomy reservoir if a membrane oxygenator is used. Another manufacturer[2] recommends that an I.V. set connect the arterial filter vent to one of the oxygenator ports for continuous, automatic venting. This manufacturer does not indicate which port should be used. With either of the above manufacturer's recommendations, a continuous flush of blood is recirculated back to either the oxygenator itself or to the vented cardiotomy reservoir via the purge line.

We devised a simple system in which the purge line is brought straight back to the perfusionist where it is easily accessible. A three-way manifold or double stopcock connects the purge line to the line which is used to draw venous blood samples and which enters the venous inlet port of the oxygenator (Figure 1). This allows the continuous, no-air-contact flush to flow directly to the venous inlet without exposing the recirculated blood to the foreign surface area of the cardiotomy reservoir, the cardiotomy filter, or the connecting tubing. In addition, by connecting the purge line to the venous inlet port of the oxygenator, we observed less splashing of the blood when it entered the oxygenator and the blood re-entered in a low pressure area which decreases the chance of air emboli entering the arterial line. Careful manipulation of the stopcocks allows the drawing of both arterial and venous samples from the same line.

Discussion

Morbidity caused by microbubbles and microparticles during cardiopulmonary perfusion has been substantiated by many investigators and include defects in the visual field,[3] central nervous system,[4,5] or respiratory system.[6] Microparticles generated during open-heart procedures are due to several causal factors. One of these is contact of the blood with any foreign surface area such as the cardiotomy reservoir, tubing, or the oxygenator. This contact results in blood aggregation.[7,8,9,10] Another causal factor is blood trauma caused during oxygenation[11] and pumping.[12,13]

To minimize the number of microbubbles and microparticles which are generated during the open-heart procedure, extracorporeal blood filtration is employed. When the arterial line filter is used as one of these extracorporeal filters, consideration should be given to

Address for Reprints: Associates In Thoracic Surgery, 5200 East Grant Road, Suite 612, Tucson, AZ 85712. Article submitted for publication Sept. 15, 1980, accepted for publication May 8, 1981.

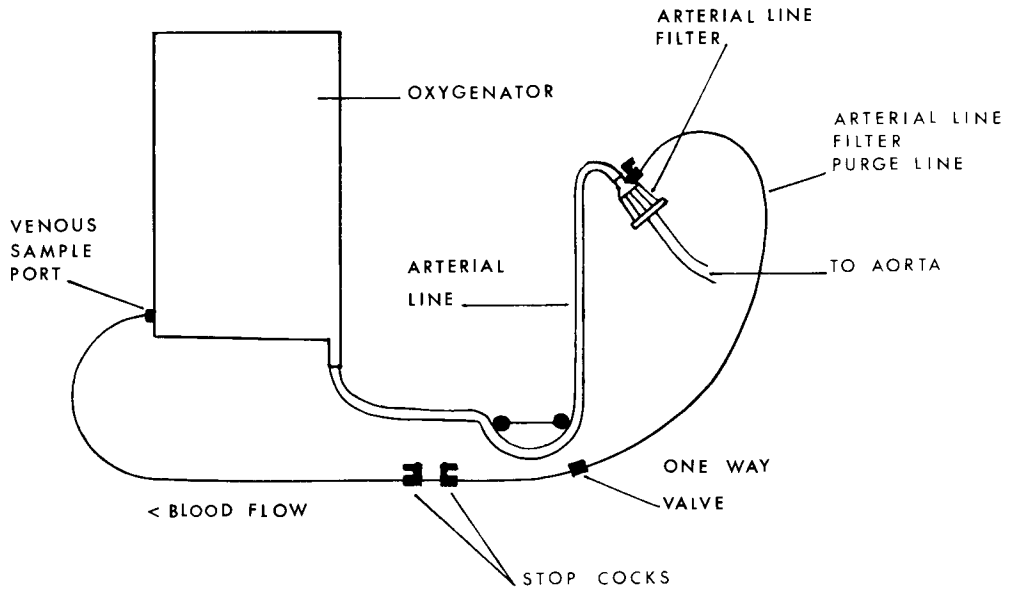

FIGURE 1. The purge line is connected to the venous sampling line with a three-way stopcock and is easily accessible to the perfusionist for drawing both venous and arterial samples.

the assembly of the filter's purge line to minimize any further trauma to the blood. By connecting the purge line to the venous inlet port of the oxygenator, we have minimized the foreign surface area to which the recirculated blood is exposed and reduced the splashing of blood into the oxygenator which decreases the number of microparticles generated. Loop[13] found in his study that blood added to the oxygenator consistently increased the number of microparticles produced during cardiopulmonary perfusion and any vibration or jostling of the oxygenator released a shower of microparticles. We observed splashing when the blood re-entered the oxygenator through the ports on the top, but did not observe this when the blood re-entered through the venous inlet port. By using the venous inlet port we therefore believe less trauma and less microparticles are generated.

Conclusion

A method to attach the purge line of the arterial line filter to the venous inlet port of the oxygenator is described. This method allows a continuous, no-air-contact flush of blood to the oxygenator through the purge line without the effects of splashing blood against the sides of the oxygenator. This method reduces the foreign surface area to which the recirculated blood is exposed and reduces the chance for air embolization into the arterial line.

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