

## Possible Gas Embolism from Double-Lumen Intra-Aortic Balloon—Case Report and Preventive Measure

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### Abstract

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Although double-lumen intra-aortic balloon catheters offer some obvious advantages over more conventional balloon catheters, they introduce another source for possible gas embolism and its complications of which perfusionists and other personnel involved with counterpulsation must be aware.

### Introduction

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Counterpulsation with an intra-aortic balloon is a method of circulatory assist which has proven beneficial in patients with acute cardiac failure.<sup>1-4</sup> At times, achieving counter-pulsation is complicated by tortuosity or atheromatous plaque formation in the distal arterial tree which hinders balloon insertion and advancement.<sup>5,6</sup> Roche Medical Electronics, now Kontron Cardiovascular, addressed this problem in 1978 by introducing a double-lumen balloon catheter which allows the use of a guidewire and pressure monitoring as adjuncts to balloon insertion and positioning.<sup>7</sup> A literature review reveals that although balloon rupture with consequent complications is rare,<sup>2,8-10</sup> there are no previous reports of catheter malfunction or defect which could lead to gas embolism.

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### Case Report

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A 67 year-old male caucasian with a previous history of myocardial infarction and pulmonary embolus was admitted to the Mississippi Baptist Medical Center with a diagnosis of acute inferolateral myocardial infarction and cardiogenic shock. Bilateral attempts at intra-aortic balloon insertion, using an AVCO 40 cc Balloon on a 4.0 mm (12 french) catheter,<sup>a</sup> failed due to obstructive lesions in the aortic iliac region. A repeat insertion attempt was successful in the left groin using an AVCO double-lumen intra-aortic balloon<sup>a</sup> with utilization of a guidewire which permitted negotiation of the difficult passage. The patient's hemodynamics improved with counter-pulsation and inotropic support. The central lumen of the balloon catheter was used to monitor central aortic pressure and balloon timing to provide maximum diastolic augmentation by an AVCO model IABP-7 console.<sup>a</sup>

Shortly after counterpulsation was initiated, blood was observed in the helium transport lumen of the balloon catheter. Shortly thereafter, the console began to exhibit intermittent low pressure and high pressure alarms which became increasingly more frequent in spite of the performance of suggested remedies in the trouble-shooting portion of the operator's manual.<sup>11</sup> During this time, the intensive care personnel encountered difficulty in

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<sup>a</sup> Kontron Cardiovascular, 9 Plymouth St., Everett, MA 02149

keeping the pressure monitoring lumen flushed and blood drained from the helium transport lumen. The patient was stable throughout this period with adequate diastolic augmentation indicated on his pressure tracings. No high leak rate alarms were experienced and therefore, counterpulsation was not discontinued because the patient was considered balloon dependent. A balloon exchange was performed as soon as a replacement became available. Counterpulsation had to be interrupted for a short time during the exchange, at which time the patient suffered an acute hypotensive crisis. After the second balloon was quickly inserted, positioned, and assist was resumed, the console began to exhibit high leak rate alarm status. In the pressure monitoring lumen of the balloon catheter (which can be seen within the helium catheter), gas bubbles were then observed advancing toward the patient. Counterpulsation was immediately discontinued and the balloon withdrawn. Cardiac and respiratory failure subse-

quently developed and the patient expired despite vigorous resuscitative measures. Permission for postmortem examination was denied.

Visual examination of the first balloon used revealed blood in all three balloon chambers and both lumina of the catheter, but no obvious defects (see Figure 1). The second balloon contained no blood and also appeared free from external defects. When the second balloon was submerged in water and inflated, gas could be observed escaping from the pressure monitoring lumen. Both balloons were forwarded to Kontron Cardiovascular for investigation. Their examination revealed that the first balloon contained a leak opening at the central lumen juncture with the bifurcation and that the opening behaved as a one-way valve allowing air or liquid from the central lumen into the helium line, but not the reverse. As to the second balloon, they reported that the balloon contained an abnormal communication between the two lumina so that when the balloon was inflated with

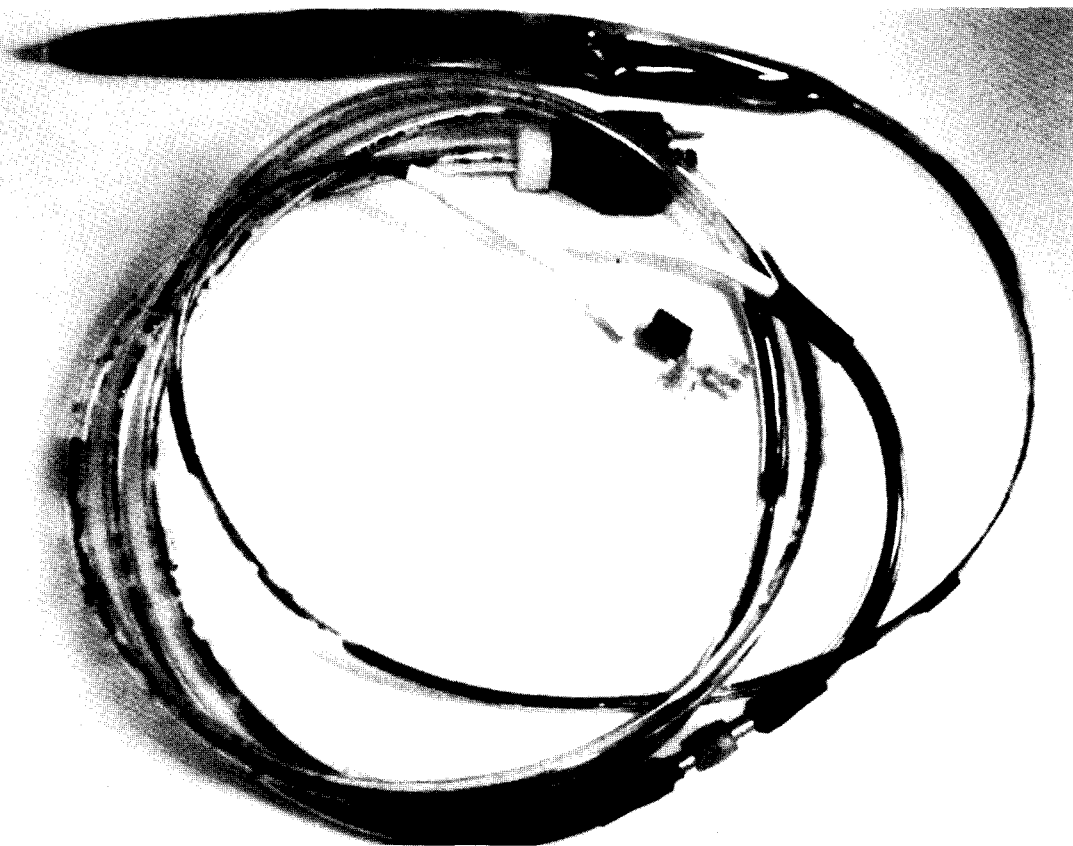


FIGURE 1. The first balloon shortly after removal with blood visible in all three chambers and both lumina.

gas at the bifurcation, gas leaked into the central lumen path and bubbled out. In both cases they stated that this type of leak was most likely caused by separation of the central lumen from the winged luer adaptor, within the bifurcation, after sterilization. They concluded that mechanical fatigue or an inadequate amount of silicone adhesive "A" potted into the bifurcation would allow separation to occur.

## Discussion

The AVCO Double-lumen Intra-aortic Balloon in a 40 cc Tri-Segment™ balloon fabricated with Cardiothane-51™ Copolymer, a non-thrombogenic material. It contains three compartments of equal length which are rapidly inflated and deflated by the console using helium as the driving gas and the patient's electrocardiogram as the trigger stimulus. The balloon is mounted on a 4.7 mm (14 french) double-lumen catheter extruded from a non-thrombogenic Cardiomat-100™ polymer. The central lumen is 1 mm inside diameter and extends from the tip of the balloon to the winged luer adaptor. A 0.035 inch diameter, 145 centimeter long, 3 mm "J" guidewire is included with each balloon. Although Kontron employs stringent manufacturing procedures enhanced by redundant quality tests to assure the safety and reliability of their products, it is ultimately up to the user to perform the final check on all products used in this critical area whenever possible.

## Recommendation

A simple procedure devised at this institution to prevent similar occurrences is as follows: utilizing sterile technique, the winged luer adaptor is oc-

cluded with the stopcock. The balloon and all of the catheter which will be inside the patient are submerged in normal saline and the balloon is inflated to ten cc over the manufacturer's specifications. Any gas observed escaping from the balloon or catheter obviously heralds a defect and is sufficient cause for discarding the balloon.

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