
Failure of the Percutaneous Intra-Aortic Balloon to Unwrap—A Case Report

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Abstract

An intra-aortic balloon which can be inserted percutaneously has become an attractive adjunct in the past few years. The major benefits of this technique are ease and speed of insertion and the lack of need for a surgical cutdown. Early concerns about post balloon removal hemorrhage due to the large catheter size (12 French) have largely proven to be unfounded. Early experience suggests that the most frequent problem associated with percutaneous insertion has been failure of the balloon to completely unwrap. This problem was observed in 17 of 96 patients (17.8%) in whom the balloon was inserted perioperatively. Usually, the problem is recognized immediately. The balloon is then withdrawn, re-wrapped, and reinserted or replaced with another balloon. In two patients, failure to completely unwrap was not recognized until later. One patient had the balloon removed while another was simultaneously inserted into the contralateral femoral artery without complication followed by improved and normal balloon function. The second patient is presented depicting recognition of the problem and subsequent solution.

Introduction

The application of a catheter-mounted balloon placed in the descending aorta to provide counter-

pulsation was first described by Mouloupoulos in 1962.¹ During the ensuing years, balloon configurations changed and were updated, based on previous experience and demand. The major changes were balloon design and smaller catheter size. This was due in large part to changes in indication for use such as acute myocardial infarction with resultant cardiogenic shock² and prophylactic balloon insertion preoperatively³ in high risk patients. The early generation of balloons required a surgical cutdown for insertion and removal.

In 1979, Bregman⁴ first described the use of an intra-aortic balloon which could be inserted percutaneously, using the technique of Seldinger.⁵ The major benefits of the percutaneous insertion technique are simplicity and speed of insertion and the lack of need for surgical cutdown to insert and remove. As simplified as the technique of percutaneous insertion is, strict attention must be paid to details, assuring an acceptably low incidence of complications.⁶ Meticulous attention must be directed to insertion so as to avoid vascular compromise or improper balloon position, and at removal, to avoid post-removal hemorrhage.

An infrequent, but potential problem with the percutaneous balloon which has not previously been adequately described, is failure of the balloon to unwrap. This is encountered in those balloons which require manual wrapping and unwrapping. If the balloon fails to completely deploy following insertion, it is usually possible to identify that as the source of ineffective pumping in a matter of minutes. Incomplete unwrapping is characterized

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by sub-optimal augmentation, alarms on the pumping console and contour of the balloon pressure tracing on the console. In two patients, it was not apparent until two to three hours after insertion that the balloons were not completely unwrapped. The following is a case report depicting delayed malfunction, secondary to improper unwrapping, in one of the two cases and its subsequent solution.

Case Report

A 73 year-old female underwent re-operation for closure of a recurrent ventricular septal defect. Following the operation, the patient was in left ventricular failure, requiring increased inotropic support. Initial attempts to insert an intra-aortic balloon via the right femoral artery were without success. For the following twelve hours, the patient remained in a low output state and suffered a cardiac arrest. At this point, it was then possible to insert a percutaneous balloon via the left femoral artery. Only fair augmentation was achieved and chest x-ray showed the balloon to be positioned too high. Accordingly, the balloon was withdrawn two to three centimeters followed by an instant console indication of volume loss. At the same time, the pulse pressure in the femoral artery was noted to be narrowed. Balloon sounds which were previously present over the left chest were now absent. Attempts to identify a leak in the external balloon tubing, as well as a console problem, were without success. After sterile preparation and draping, the ligatures around the sheath were re-

moved. The balloon was aspirated and easily withdrawn. A second balloon was then successfully inserted into the sheath, appropriately positioned, and functioned satisfactorily. Inspection of the withdrawn balloon indicated it was possible to withdraw it from the sheath as only the most proximal 30–35% of the balloon was unwrapped (Figure 1).

Observations

Initial observation of the balloon following removal discounted the possibility of balloon rupture during or after insertion. This was not considered initially as insertion was with ease and no obstruction was encountered. It was noticed, however, that the balloon was not completely unwrapped. With that observation, the question was why the *delayed* malfunction? In retrospect, the following appears the most likely explanation.

The event triggering the alarm and exposing the problem was repositioning the balloon. This allowed a tract to develop to the balloon tip, allowing a second smaller segment to deploy (Figure 2). This was confirmed by placing the balloon in a basin of water and inflating to its 40 cc volume. Apparently, after initial insertion and incomplete unwrapping, the balloon console sensed the proximal 30–35% which unwrapped as the entire balloon. This allowed the system to function normally. As the balloon was withdrawn, a tract developed to the balloon tip and the console sensed this as a leak, alarmed, and appropriately ceased to operate. The proximal unwrapped segment was

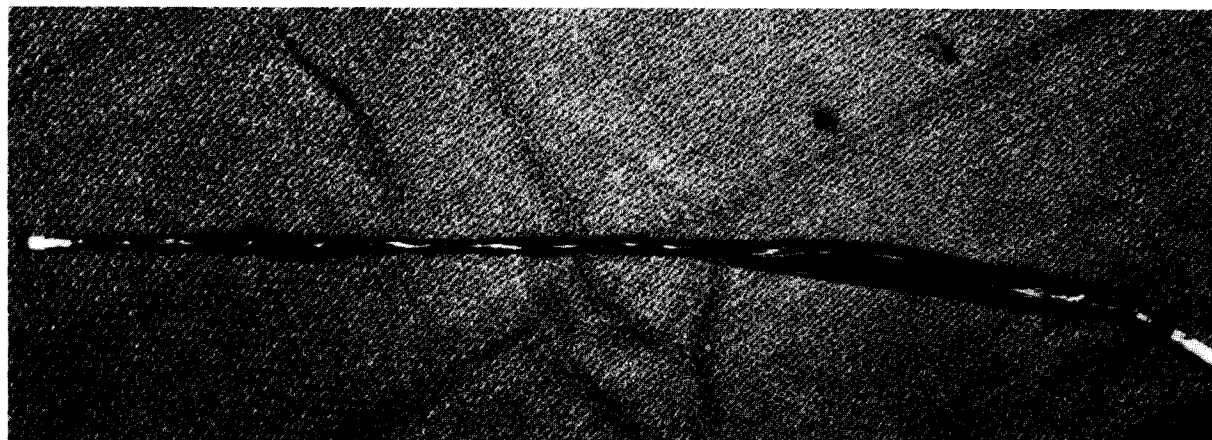


FIGURE 1. Balloon after removal showing only the most proximal 30–35% to be unwrapped.

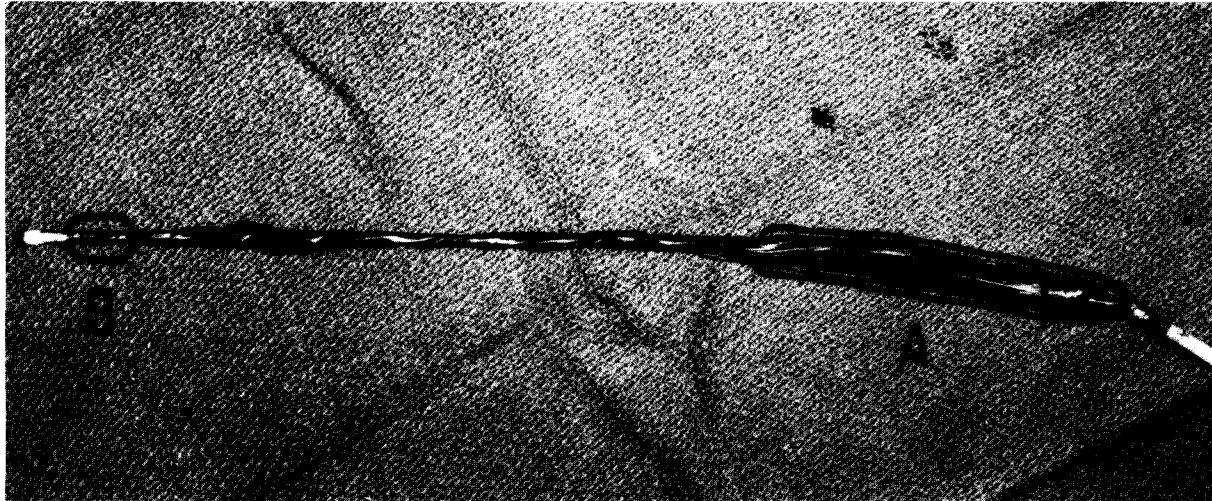


FIGURE 2. Initially, only area "A" was unwrapped. The tract then developed to the balloon tip "B".

probably over-inflated and could not deflate in one cardiac cycle. This would manifest as an obstruction to distal flow and account for the narrow pulse pressure as observed in the femoral artery (Figure 3). The balloon was returned to the manufacturer where analysis revealed no structural defect.

Discussion

The intra-aortic balloon is the most frequently used form of mechanical support for circulatory instability.⁷ Indications for its use and results are well documented.^{8,9,10} Despite the benefits of using the balloon, there are complications associated with its use.¹¹ These complications are usually related to the vascular system.^{12,13} Initial reports¹⁴ indicate a percutaneously inserted balloon may decrease vascular complications. The relative ease and speed of insertion of this balloon allow for

more rapid onset of balloon pumping and perhaps an enlarged spectrum of patient application.¹⁵

Recent design changes in percutaneous balloons have led many centers to make them the balloon of choice. Failure of the balloon to unwrap is a previously seldom reported complication. Careful attention to insertion technique and particularly wrapping of the balloon are essential to a successful insertion. Should unwrapping fail to occur, this will *usually*, but not *always*, be noticed almost immediately following insertion. If this occurs, the balloon must be removed and rewrapped or replaced with another balloon prior to reinsertion. In those patients who exhibit less than optimal augmentation for the situation, and where there are problems with console alarms indicating a possible balloon malfunction, failure of the balloon to unwrap should be considered in assessing the problem. Newer models of the percutaneous balloon

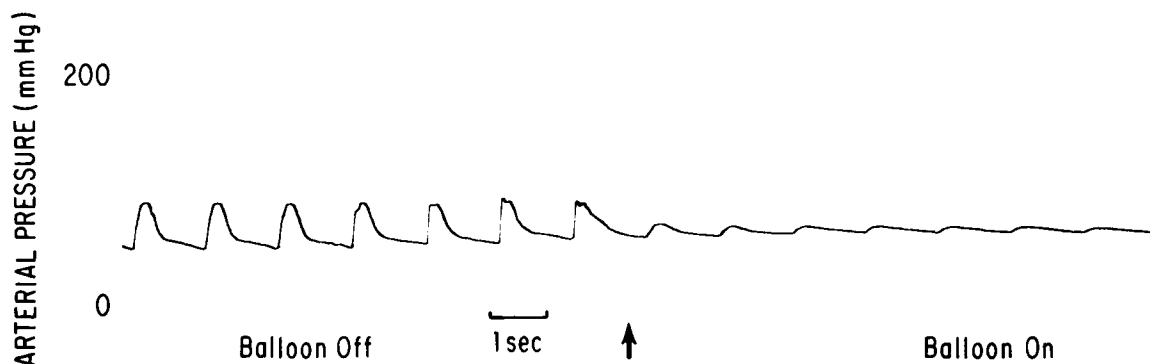


FIGURE 3. Arterial pressure at left with balloon off compared to narrowed pulse pressure with balloon on.

are not fail-safe but when used properly, assure a more uniform wrapping and complete unwrapping. This is accomplished by the use of a handle that allows automatic wrapping and unwrapping.

At our institution, we began to use the percutaneous balloon in 1978. The described problem occurred within the first two years of use. Since changing to the newer "automatic" wrapping balloon, in over 100 patients, we have not encountered a single similar problem.

Conclusion

Failure of a percutaneously inserted balloon to unwrap is a previously seldom reported complication. Recent design changes have minimized, if not eliminated, this problem. However, this complication should be considered in assessing late failure of balloon function.

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