CASE REPORT

A Rare Complication of the Percutaneous Intra-Aortic Catheter: Inadvertent Puncture during Surgery

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Abstract

A 58 year-old male underwent urgent aorto-coronary bypass surgery for unstable angina. A 40cc. percutaneous intra-aortic balloon was inserted pre-operatively, resulting in good augmentation. No problems were observed in the Coronary Care Unit and the patient was stabilized.

Approximately 45 minutes post aorto-coronary bypass, diastolic augmentation drastically changed. During inspection of the balloon catheter, a Kelly clamp, partially occluding the catheter, was found. The Kelly clamp was removed and augmentation was resumed.

While preparing the patient for transport from the Operating Room to the Intensive Care Unit, augmentation by the Intra-aortic balloon pump was temporarily stopped. All attempts to resume augmentation were unsuccessful. Close visual inspection of the catheter showed 2 holes just proximal to the site of the Kelly clamp occlusion. It was later determined that these holes were made with a towel clamp. Effective repair of the catheter could not be made and the balloon was removed.

Introduction

The primary rationale for the development and eventual clinical use of intra-aortic devices was to provide mechanical support to the failing left ventricle usually resulting from myocardial infarction, provide assistance for cardiogenic shock, or to compensate for a diminished cardiac output following cardiac surgery.[1,2,3]

Improvements in console electronics, ECG pattern recognition, catheter design and insertion techniques are major contributing factors to the increased application of these devices. The subsequent ease of use and relative safety stimulated expansion to the prophylactic management of both mild and moderate hemodynamic compensation.[4,5]

Numerous reports can be cited in the literature substantiating the resultant hemodynamic benefits and therapeutic effectiveness of counterpulsation. However, numerous complications have also been cited. Some of these are: thrombocytopenia, vascular injury or occlusion in the limb, aortic wall damage or dissection, arterial embolic complications, wound infection and balloon malfunction or rupture.[6,7,8,9,10]

This case report describes yet another complication. This event is unique in that the actual complication was not related to either the patient or to the cardiac assist system.

Case Report

A 58 year-old male underwent insertion of a 40cc. percutaneous balloon for post-infarction angina. Patient systolic unloading and diastolic augmentation were satisfactory. The console used

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was a Kontron Model 10.[a] This console has the capability of triggering augmentation in three modes: ECG, arterial waveform, or internal R wave simulator. The balloon was triggered selectively using either patient ECG or arterial waveform. Selection was dependent on the electrocautery unit. Cardiopulmonary bypass was initiated and cardiac asystole was achieved with cardioplegia. Counterpulsation was reinstituted using the internal R wave simulator. No problems were noted during bypass.

The aortic clamp was removed and spontaneous recovery from asystole ensued with subsequent augmentation with the patient's ECG. Cardiopulmonary bypass was terminated and patient hemodynamics were stable.

Approximately 45 minutes after bypass was terminated it was noted that diastolic augmentation had drastically changed. The augmentation had been satisfactory 15 minutes prior to this occurrence. Change in diastolic augmentation could not be effected in either the ECG or arterial wave form mode. The balloon catheter was then checked for any irregularities. After inspection it was discovered that a Kelly clamp had inadvertently partially occluded the catheter distal to the bifurcation (Figure 1). The Kelly clamp was then removed and normal augmentation was resumed. During preparation for patient transfer, the balloon pump was turned off to observe non-augmented arterial pressure. All attempts to resume augmentation were unsuccessful. Close visual inspection showed 2 holes just proximal to the site of the Kelly clamp occlusion. It was later determined that these holes were made with a towel clamp (Figure 2). It was decided that effective repair could not be made on the catheter and the balloon was removed. Reinsertion of a second balloon was not necessary since patient hemodynamics were stable.

Discussion

The Kontron Model 10[a] is capable of correcting or alerting the user to a variety of common problems during augmentation. The operator must be aware that most of the failsafe features are only activated in the "auto" mode. The balloon console, when used in the "manual" mode should be carefully monitored because of the absence of these failsafe features.

After final analysis of the situation it was evident that there were three separate problems: first, the partial occlusion of the balloon catheter with a Kelly clamp; second, the penetration of the catheter with a towel clamp; and third, balloon operation in the "manual" mode. It should be noted that the mode of choice is "auto." However, there are situations that require operation in the "manual" mode, and such situations might be electrical interference during electrocautery use, arrythmias, etc. Apparently the balloon was operating in the "manual" mode with no problems.

We were not aware that a towel clamp had penetrated the balloon catheter during draping. Apparently because of the sealing effect of the towel clamp itself in the catheter, the systolic and diastolic augmentation were unaffected.

Approximately 45 minutes after bypass a disposable sucker tip was contaminated and removed from the table. When the sucker tip tubing for the new tip was attached to the drapes, the balloon catheter was also partially clamped, causing the drastic change in diastolic augmentation. The console, being in the "manual" mode did not alarm. However, the perfusionist immediately noticed the change, and proceeded to correct the problem by locating and removing the clamp. Balloon augmentation was resumed and the console put in the "auto" mode. A few minutes later the surgeon requested that non-assisted arterial pressure be recorded and the balloon augmentation was turned off. Simultaneously, the drapes were removed from the patient. The towel clamp that had originally penetrated the catheter was also removed, causing a substantial leak. It should be noted that when the Model 10 console[a] is turned off and subsequently turned back on again, the "auto" mode automatically reverts to the "manual" mode and must be manually activated to the "auto" mode after "manual" augmentation has been established. In this case, balloon augmentation was attempted with no response. Upon close visual inspection the two holes made by the towel clamp were found. Due to the unusual site of the puncture and the hemodynamic stability of the patient, the balloon was removed.

The balloon console, in the past, has been operated in the "manual" mode. We have now be-

[a] Kontron Inc., Everett, MA 02149.

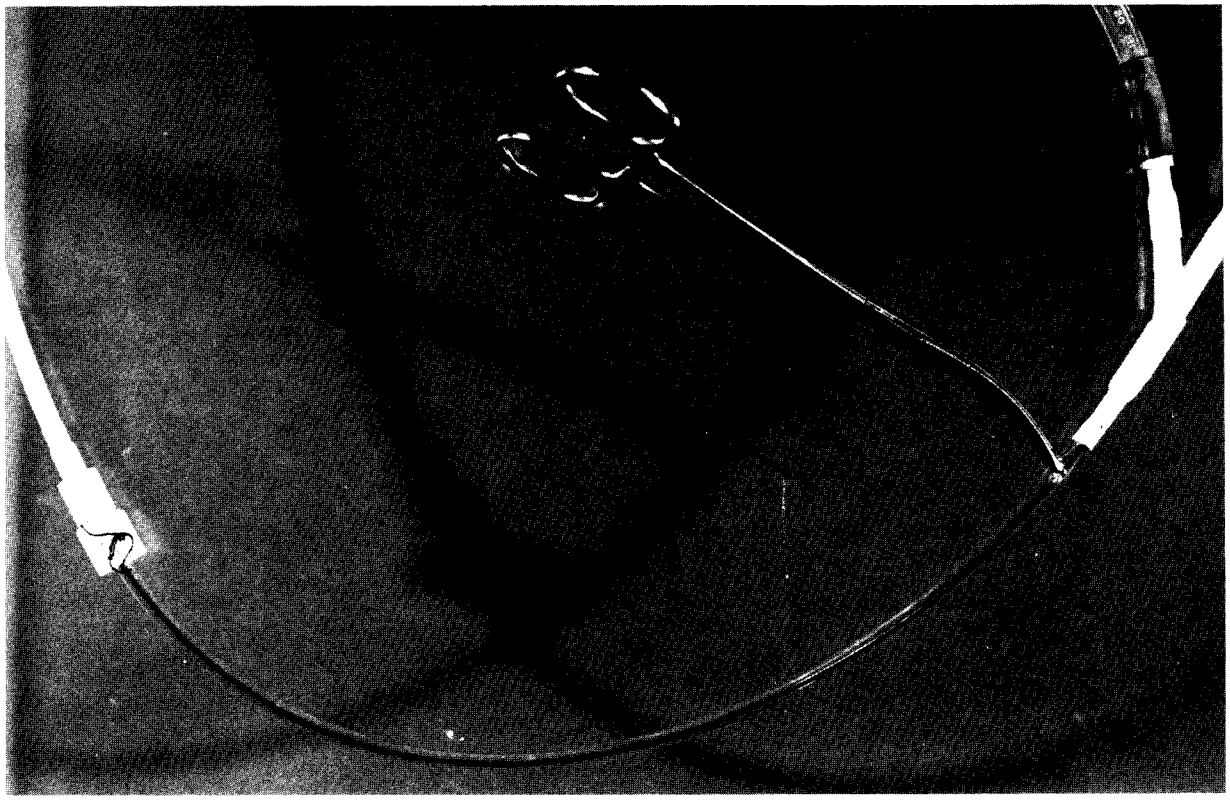

FIGURE 1. Kelly clamp partially occluding balloon catheter.

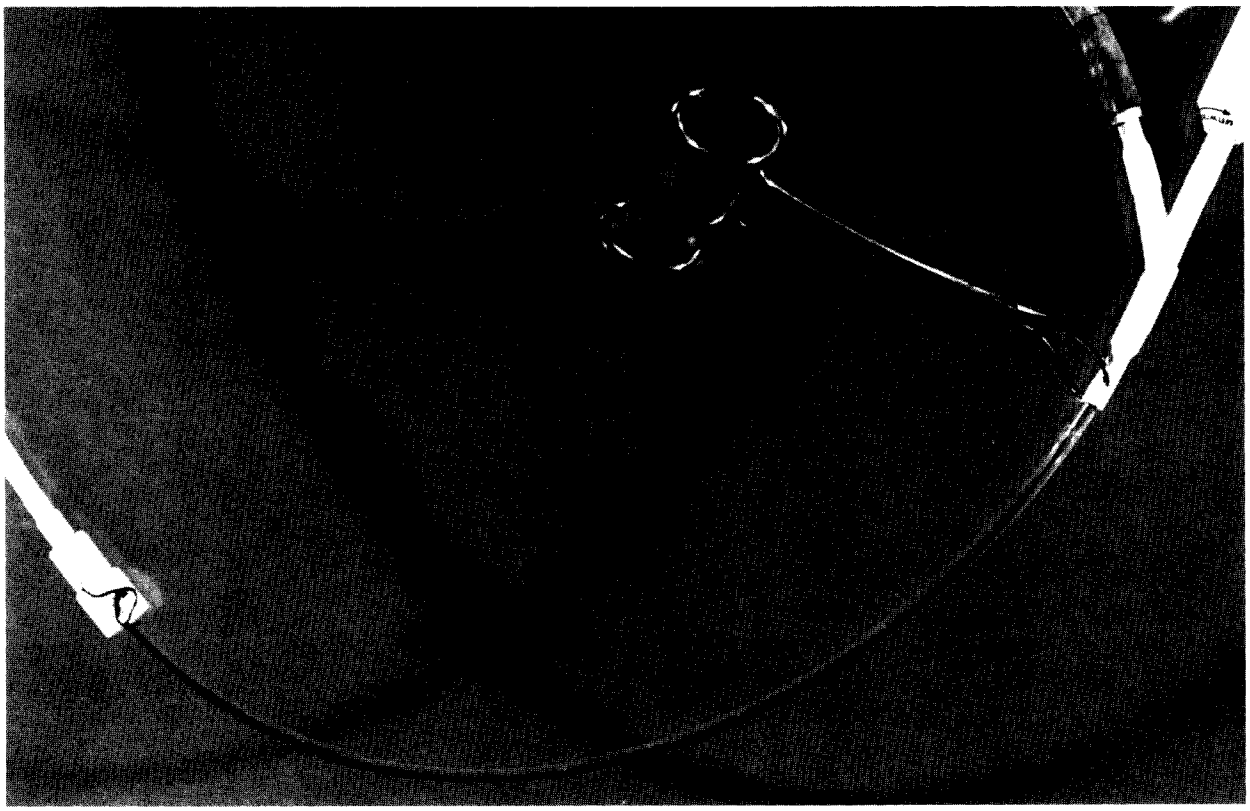

FIGURE 2. Penetration of balloon catheter with towel clamp.

come more aware of the importance of the "auto" mode failsafes, specifically, the venting of the balloon in this particular case. Fortunately, the perfusionist realized that the change in the diastolic augmentation of the arterial pressure waveform indicated a problem associated with the balloon catheter. If the balloon console had been in the "auto" mode this would have been diagnosed immediately by the balloon computer as "high pressure." Observation of the gas pressure trace may also have diagnosed the problem. If it were possible for the balloon to be operating in the "auto" mode when the towel clamp was removed, the console would have alarmed "high leak" as well as the gas pressure trace dropping below baseline, also indicative of a leak. When counterpulsation was again attempted, the console "thought" the balloon was purging helium because of the large leak.

This complication may have been avoided if there was better visability of the balloon catheter during surgery, as well as more awareness of the operating room personnel to these potential hazards. Since the incident, we are now exposing the greatest length of balloon catheter possible for constant visibility and as has been our past practice we use the "auto" mode, according to the manufacturers' recommendations whenever possible.

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