Conversations in Cardiology: Management of Pericardial Drains

Dr. Morton Kern with contributions from Drs. Richard Bach, Washington University, St. Louis, Missouri; David Cohen, St. Francis Hospital, Roslyn, New York; Douglas Drachman, Massachusetts General Hospital, Boston, Massachusetts; Kirk Garratt, ChristianaCare, Wilmington, Delaware; Ajay Kirtane, Columbia University, New York, New York; Steve Ramee, LSU Health Science Center, New Orleans, Louisiana; Barry Uretsky, University of Arkansas, Little Rock, Arkansas

After working to secure the pericardial drain in a patient after pericardiocentesis, Dr. Douglas Drachman brought up an issue on the management of pericardial drains. In his role as Director of Quality and Safety in the Massachusetts General Hospital Cath Lab, Dr. Drachman recognized that adherence to his institution's protocol could be challenging and might vary, depending on the patient's floor assignment after the procedure. He sought to standardize their approach and to incorporate contemporary best practices. To this end, Dr. Drachman asked this series of operational questions to our group of cath lab experts:

- Who is responsible for the management (drainage, flushing), especially after hours, and does it vary depending on which ward the patient resides in your institution, or what time of night/day?
- Do you limit how long the drain is left in place?
- At what parameter do you advocate removal of the drain (eg, less than 50 cc drainage over 24-hour period, check echo, then remove)?
- Do you use prophylactic antibiotics while the drain remains in place?

How does your institution manage pericardial drains once inserted?

- Do you attach a stopcock to the hub of the drain and manually withdraw fluid (and/or flush) at regular intervals?
- Do you leave the catheter attached to a closed system that drains to gravity, a Jackson-Pratt bulb, or wall suction?

Mort Kern, Long Beach, California: Douglas, it seems like a routine issue for drain management and I'm sure there are many ways to do it. Two universal goals seem obvious: 1) empty the pericardium; 2) prevent infection.

There are several types of pericardial catheters. Most are around 8 French (F) and are usually straight-tipped with multiple holes. Nonetheless, viscous pericardial fluid with fibrin or blood can clot the lumen, raising the issue of flushing. I'm always concerned about flushing material into the pericardium after leaving the lab. Our usual procedure is to remove or cover the stopcock that was connected to prevent flushing backward into the pericardium (Figures 1-2). The system is closed and left to drain by gravity. The nurses in intensive care unit (ICU) manage the lines with sterile bandages, and the fellows and attending physician evaluate and remove the drainage system. We remove the drain when fluid stops or is <50 mL/24 hr, otherwise it stays in place. If it continues to drain >25mL/hr, then it stays in place. Repeat echos are done each morning/afternoon. After pulling the drain, we recheck an echo 8-12 hours later. Rarely have we had to go back and retap. No antibiotics are given. Let's see what others might do.

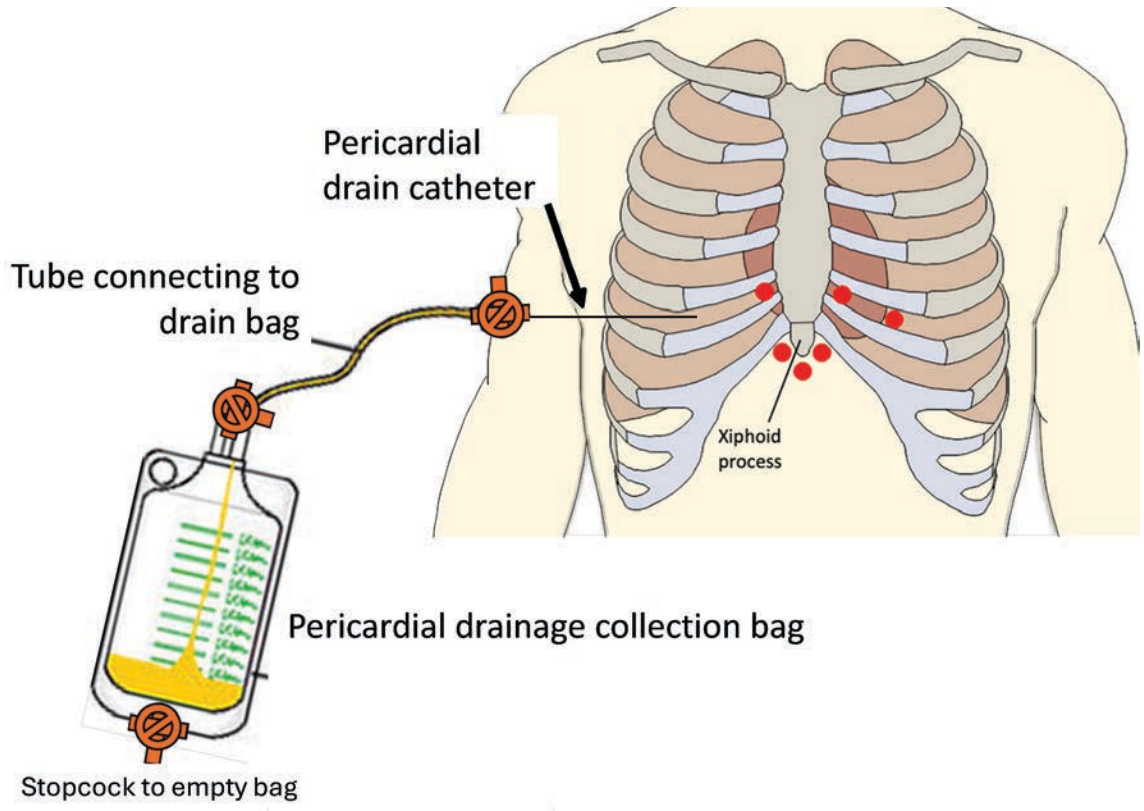

Figure 1. Proposed pericardiocentesis drainage catheter system, tubing, and drainage bag. Stopcocks are often used as connectors.

Ajay Kirtane, Columbia University, New York, New York: We typically do flush each shift via stopcock. Nursing in the CCU is able to do this (but patient has to be in the CCU). The other port of the stopcock drains by gravity to the collection bag. We monitor (drain) output and typically pull when <50-100 cc/day. I typically try to make sure that we have a point-of-care ultrasound (POCUS) or full echocardiogram before pulling the drain. The fellows typically pull these drains, but it's important to be sure that the interventional fellows have a "list" of these patients or sometimes things get lost. I know of a case where someone assumed it was like a Jackson-Pratt (JP) type drain and the pericardial catheter was left in for a long time inadvertently. (It came out with a wire in the cath lab but was suboptimal). We don't give prophylactic antibiotics.

Kirk Garratt, ChristianaCare, Wilmington, Delaware: We recently tossed around ideas for managing these patients. Our medical ICU is reluctant to take them, which is understandable, but often the effusion is related to something (eg, cancer, uremia needing dialysis, etc.,) cardiologists aren't fully equipped to manage.

About a year ago, a pericardial catheter was needed in the dead of night (why does tamponade only happen between 10pm and 6am?) for a patient with a hematologic malignancy experiencing tumor lysis syndrome. The medical intensivist advised keeping the patient in the CICU and giving them Rasburicase, a drug few in cardiology had ever heard of and none had ever used. Since mortality with this syndrome can be 15% or more, a spirited debate ensued. In the end, the patient went to the medical ICU, a cardiologist and fellow co-managed the patient (well, the drain, anyway), and it ended well. This event was reviewed formally and led to criteria for triaging patients with pericardial catheters:

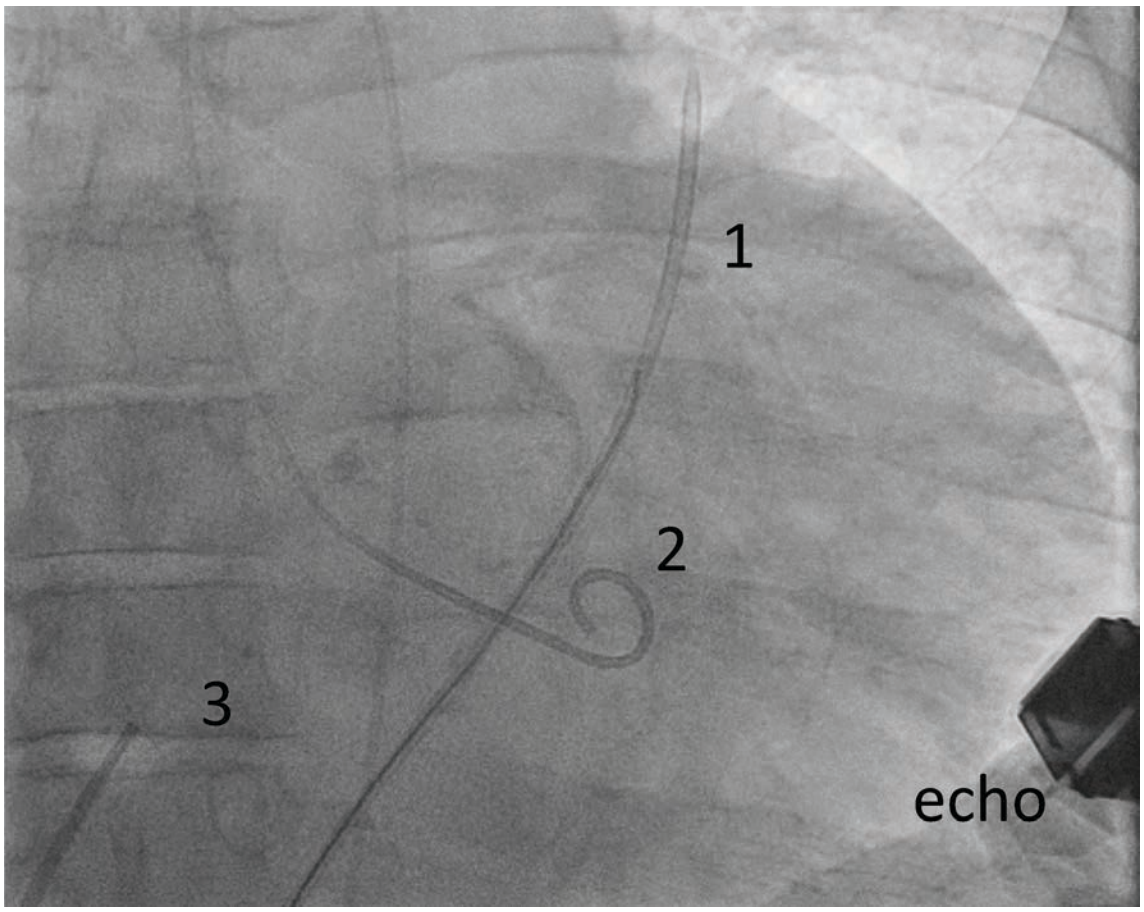

Figure 2. Frame from cineangiogram showing 1) pericardial catheter, 2) left ventricular (LV) pigtail catheter, and 3) right atrial catheter. Echo transducer at apex is used to visualize pericardial fluid and echo bubbles to confirm entrance into pericardial space.

- Undrained pericardial effusions go to CICU for monitoring (very rare). Pericardial effusions that are adequately drained go to the unit best equipped to manage the underlying issue:
  - To the medical ICU if patient is (or presumed to be) in septic/vasodilatory shock, has primary respiratory failure, complex active non-cardiac comorbidities (including malignancy), infection including endocarditis with a stable valve, pulseless electrical activity (PEA) arrest and massive/submassive pulmonary embolism (PE).
  - To the CICU if patient is (or presumed to be) in cardiogenic shock, has unstable arrhythmias with hemodynamic instability, acute coronary syndrome (ACS), severe valvular disease, endocarditis with valve instability, any ventricular tachycardia (VT) arrest, or need for any mechanical circulatory support.

For the pericardial catheter system, we usually place a stopcock and manually drain the catheter each shift. Flushing during/after each drainage is done by CICU nurses, but if in the medical ICU, the job may require a fellow. No antibiotics are given, just rigorous sterile technique. The catheter is pulled out as early as possible, usually when drainage is <30-50 cc/24 hr. Follow-up echo is generally not needed but almost always done.

Barry Uretsky, University of Arkansas, Little Rock, Arkansas: We attach a stopcock to the end of the catheter which is then attached to tubing and a drainage bag. The stopcock is capped, and the drainage bag is kept below the patient level. We use a closed system with continuous drainage by gravity. When drainage has stopped, aspiration from the capped stopcock is performed. If fluid aspirated, a repeat echo is performed prior to the catheter removal. Nurses in the ICU are given instructions and are responsible for drain management. The cardiology team will typically aspirate the catheter. There is no formal time for drains to be in place, but they are rarely in for more than a few days, and removed when there is little drainage for 12-24 hr and echo shows minimal fluid. No routine antibiotics are given and in my personal experience, I have not seen pericardial infection because of a drain left in place.

It seems like a routine issue for drain management and I'm sure there are many ways to do it. Two universal goals seem obvious: 1) empty the pericardium; 2) prevent infection.

Richard Bach, Washington University, St. Louis, Missouri: For management in the lab, we aspirate via a 3-way stopcock on the end of the drainage catheter using a 50 cc luer-lock syringe. The contents of the syringe then go into the drainage bag that comes with the pericardiocentesis kit. At the end of the procedure, we empty all the fluid from the drainage bag (via the bottom stopcock) using a large-bore admix needle into a 1L vacutainer bottle and send that large volume sample for cytology analysis. While still sterile, we then use a sterile scissors to cut the drainage bag off the tubing so that we can plug in a Jackson-Pratt bulb to the end of the pericardial tube, and leave it under vacuum to facilitate continued drainage, with a 3-way stopcock still at the connection of the drain and the tubing. From personal experience, I believe the JP bulb does a better job of maintaining drainage flow over the next couple of days. I leave a 10 cc luer-lock syringe attached to the side port of the stopcock to maintain a closed system, yet to be able to turn the stopcock and aspirate if ever needed.

Our system is a closed drain attached to a Jackson-Pratt bulb. The nurses are familiar with aseptically emptying the JP bulb when full and restarting the vacuum. The drain is managed in the CCU by the CCU nurses. We don't routinely have a pericardial drain managed on a floor service. We never flush into the pericardium for fear of bacterial contamination. If the drainage slows down or stops, we (the fellow) will always do a prompt bedside echo to check for recurrent effusion, day or night, and if present, the medical team will be able to simply turn the stopcock and aspirate to restart flow (I would estimate that happens about 10%-20% of the time).

We plan to leave the drain in for no more than 48 hours but occasionally extend to 72 hours, but if there is continued significant drainage at that point, we consult surgery for a pericardial window (although frankly getting that procedure can take another couple of days, so we usually ask for the consult at 48 hours and cancel the surgery if drainage then drops off). I think you usually have an idea at 48 hours if there is just still too much ongoing fluid production to safely pull and be without a drain. We try to make sure that treatment (colchicine, NSAIDs) starts ASAP after the procedure.

Lastly, we consider removal when drainage decreases to <50 cc over a 12-hour period (along with a bedside echo showing no re-accumulation). Often the rate of drainage will decline rapidly over a several-hour period so that it is obvious that there is minimal ongoing fluid production for a few hours; if the bedside echo also then shows no effusion, we have confidence it is safe to pull. We do not use prophylactic antibiotics.

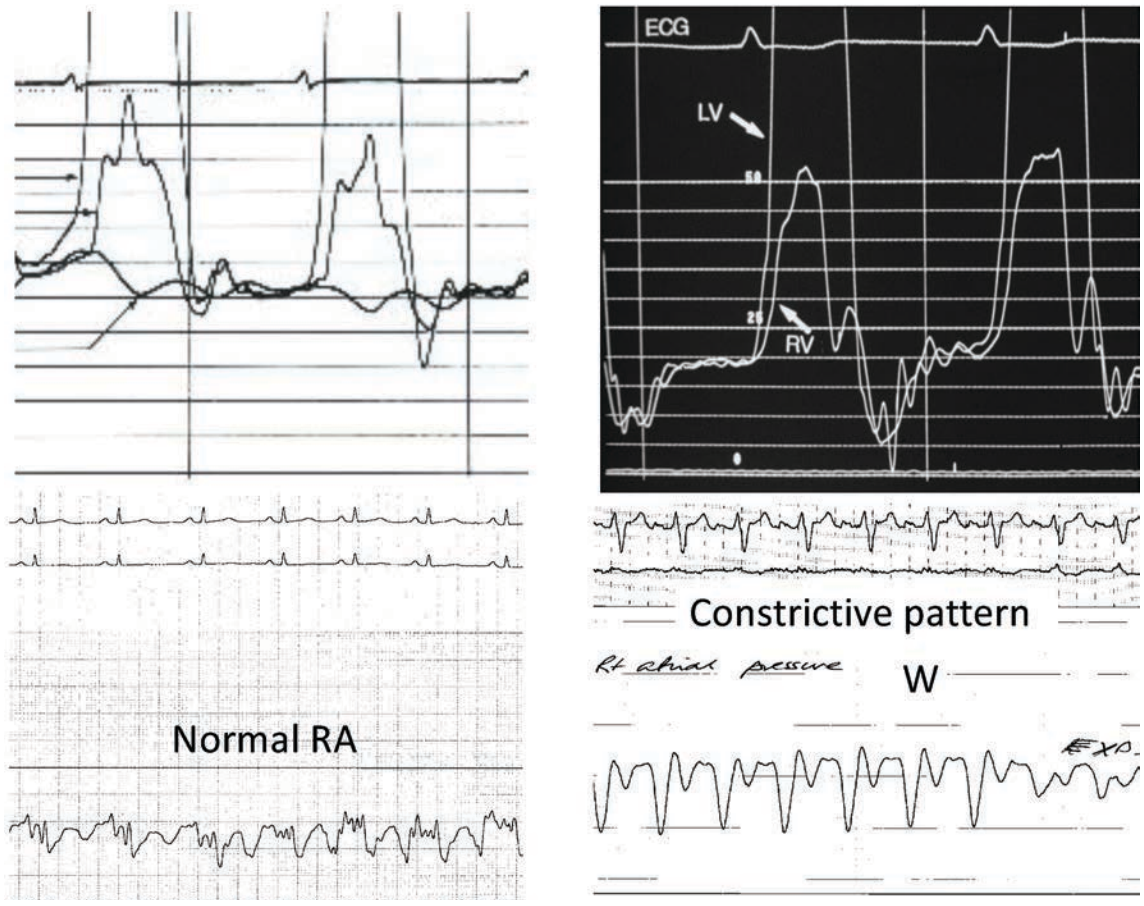

Figure 3. Hemodynamics of cardiac tamponade (top, left with left ventricular (LV), right ventricular (RV), and right atrial (RA) pressures, 0-40 mmHg scale) and constrictive physiology (top, right with LV and RV pressures, 0-50 mmHg scale). Normal right atrial pressure is shown on lower left. The elevated RA pressure and 'w' shaped waveforms of the 'a' and exaggerated 'v' with blunted 'x' descent is shown lower right. In tamponade, there is elevation of all diastolic pressures with blunted x, and Y descent. In constriction, there is exaggerated Y descent (dip) and flat or no diastolic filling, creating a plateau waveform.

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David Cohen, St. Francis Hospital, Roslyn, New York: I attach a stopcock to the hub of the drain and instruct the nursing staff to flush with 5 cc normal saline (NS) q shift (using careful sterile technique, of course). After initial drainage in the cath lab with a vacuum bottle, I connect the pericardial bag and let it drain by gravity. The nursing staff in the CCU is responsible for management of the drainage catheter. Personally, I have never sent a post-pericardiocentesis patient to a unit other than the CCU. Once drainage is <50 cc per 24-hour period, I remove the drain. We do not limit how long the drain is left in place, although from a practical standpoint, if the patient is still draining a lot of fluid after 72 hours, they are likely to get a surgical or percutaneous pericardial window. No antibiotics ever given.

Steve Ramee, LSU Health Science Center, New Orleans, Louisiana: I agree with David Cohen, except that the staff and fellow who put in the drain are responsible for checking on it daily and pulling it when drainage has subsided.

The Bottom Line

A pericardiocentesis removes pericardial fluid from within the pericardial sac for either therapeutic or diagnostic reasons.[1-4] Cardiac tamponade with hypotension is an emergent, life-threatening condition that occurs when the pericardial fluid pressure exceeds that of the right heart pressures, impairing cardiac filling and adequate cardiac output (Figure 3). For symptomatic tamponade, pericardiocentesis may be performed in any setting (emergency department, bedside, in an ambulance, if necessary, with the right equipment and personnel). While emergent pericardiocentesis can be performed anywhere, the procedure is best performed under controlled conditions in the cardiac cath lab. Following the placement of the pericardial drain, our experts' consensus suggests that in the lab with sterility maintained, the catheter can be flushed. Once the patient goes to the CCU, no further flushing into the pericardium should occur and after the fluid drainage is <50-100 mL/24 hr the drain is removed, usually by the cardiology team. Repeat echocardiograms are routine both acutely before discharge and often at follow-up. I hope this helps those seeking to establish standard protocols for best care of the post-pericardiocentesis patient. ■

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Disclosures: Dr. Morton Kern reports he is a consultant for Abiomed, Abbott Vascular, Philips Volcano, ACIST Medical, and Opsens Inc.

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