Ask the Clinical Instructor

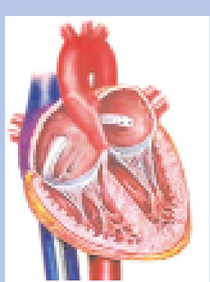
A Q&A column for those new to the cath lab

This month's column features guest contributor Todd Ginapp, EMT-P, RCIS, FSICP. He is the Cardiology Manager for Memorial Hermann Southeast in Houston, Texas. Todd also teaches an online RCIS Review course for Spokane Community College, in Spokane, Washington.

We occasionally have a couple of physicians who will perform transeptal procedures. Why are they doing this, and what are they looking for?
— RCIS Online Review Student, Spokane Community College

With the advancing technologies of echo and trans-esophageal echo (TEE), the instances of transeptal heart catheterization (TSHC) is becoming more limited. Some of the indications for TSHC include: (a) Mitral valve analysis; (b) Mitral valvuloplasty; (c) Direct LV pressure reading if patient has artificial aortic valve; (d) Ablation of left-sided pathways (EP procedures); (e) Repair of congenital defects in the atrium; (f) Anytime access to the left atrium and left ventricle is blocked through the normal aortic route.

The physician will utilize a special 8 french sheath and needle system (Brockenbrough, Mullins, Cook, etc.) to access the vein in the groin and then advance the system to the right atrium. Once at the right atrium, the physician will utilize techniques under fluoroscopy, or with the use of intracardiac echo (ICE, Boston Scientific), to guide the tip of the needle to the atrial septum. The mid-septum is the narrowest portion of the right atrium/left atrium septum. This is the location of the foramen ovalis, which sometimes remains slightly open and can allow the equipment to be pushed through to the left atrium without the use of a needle. If this is not the case, then the physician will push the needle through the septum into the left atrium. This process will be evident by waveform and pressure changes while hemodynamic monitoring is obtained from the needle/sheath during advancement. Left atrium placement can be confirmed by these pressure readings, or by contrast injection into the left atrium.



Now the physician can obtain direct mitral valve gradient analysis with a tandem left ventricular catheter. To properly evaluate a valve, pressures on each side of the valve must be known. This direct analysis is helpful in cases of pulmonary disease or other situations in which a wedged Swan-Ganz catheter is not accurate enough to use as the equivalent of the LVEDP (PCW = LAmean= LVEDP).

After TSHC, delivery of devices for repair of patent foramen ovalis (PFO) or atrial septal defects (ASD) can be performed. The main risks of TSHC are inadvertent puncture of adjacent structures, such as atrial appendages, mitral valve and most importantly, the aorta. Aortic puncture will be clearly evident during pressure monitoring during the puncture procedure. Monitoring will likely occur on a 40-50 scale, and if the waveform goes "off scale," aortic puncture must quickly be ruled out. Clotting when the equipment is in the left atrium is also a risk, but should be minimized through the usage of heparin. The complication rate of TSHC is near 2%.[1]

After the procedure, the device is removed, with rare occurances of bleeding or shunting. The pressure from the left atrium is generally enough to close any opening between the two chambers. While TSHCs are rarely performed, they do have their place in current catheterizations.

Reference

1. Braunwald E, Zipes DP, ed., Libby P, ed., Bonow R, ed. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 7th ed*. Philadelphia: W.B. Saunders Company, 2004.

I know that 'EDP' stands for end-diastolic pressure. When I monitor, the computer estimates these. What am I looking for and what does it mean?
— RCIS Online Review Student, Spokane Community College

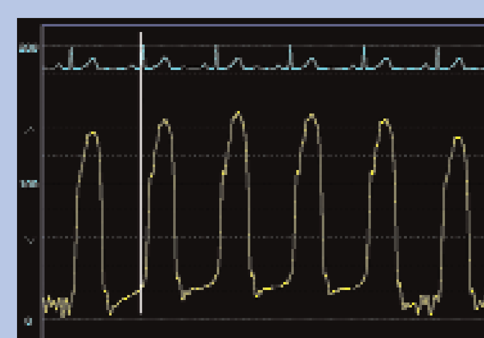
You are correct that "EDP" stands for "End-Diastolic Pressure." This is the measurement of the pressure in the ventricle at the end of the filling phase (diastole). Elevation of this pressure can be a key identifier for CHF and other forms of heart failure.

Imagine a rubber band that when stretched and released numerous times, always returns to its original shape (Frank-Starling principle). There may be a point when the rubber band stretches, but no longer returns to its completely original shape. The mechanical function of the left ventricle is similar to this rubber band, stretching during diastole and returning during systole. When it does not return to its normal position, the heart loses its ability to contract, resulting in a decrease in cardiac output and also an increase in the amount of blood remaining in the ventricle after systole. The leftover blood adds to the blood filling during diastole, and this increases the pressure in the left ventricle at the end of diastolic filling (LVEDP). An increase in LVEDP causes blood to back up in the left atrium, pulmonary system, and eventually the right ventricle and right atrium become congested and this "backup" spreads to the systemic circulation.

Obtaining the correct information can be critical in patients experiencing CHF. While many sources will quote different numbers, an LVEDP of less than 15 is usually considered normal. These pressures can be obtained in the cath lab by placing a catheter in the left ventricle and recording the pressures (of course, proper leveling and zeroing occur at the start of the case, right?). If the LV is unable to be accessed, a Swan-Ganz catheter can be 'wedged'. In normal pulmonary and mitral valve conditions, pulmonary capillary wedge pressure = left atrial mean pressures = left ventricular end-diastolic pressures.

PCW = LAmean=LVEDP

Of course, this would not be the case in pulmonary hypertension and/or mitral valve stenosis and/or regurgitation.



LVEDP is measured at the start of systolic ejection, or at the point where pressure rises. To 'eyeball' this at the table, you can reference the QRS complex. The QRS represents the depolarization of the ventricles, which results in ventricular systole. If you draw a line visually straight down from the QRS complex to the ventricular waveform, this will put you in the right area to determine the LVEDP (remember to utilize and adjust pressures at the end-expiratory phase).

In this graphic, we can see that by applying the "draw down" process, we see the LVEDP is slightly elevated at a pressure of approximately 20mmHg. This method gives us a simple approximation so we can determine if the LVEDP is "high," "low" or within a "normal" range. The computer will estimate the average from all the wave forms on the screen. Remember, in cases of exaggerated respiratory variances, utilize end-expiratory measurements. ■

Still learning about the wide variety of patients that visit the cath lab? Could your question be one that others share as well?* CLD *can help.

Submit your question to:
Jason Wilson, RCIS at **hrtfixr7@yahoo.com**