

FOREWORD

TRANSSEPTAL LEFT HEART CATHETERIZATION: THE PAST – THE PRESENT – THE FUTURE

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In the 1950s, the most frequently performed cardiac operation worldwide was mitral valvotomy for rheumatic mitral stenosis. Assessment of the hemodynamic severity of the stenosis, and perhaps even more important, determination of the presence and severity of accompanying mitral regurgitation, were critical to the selection of patients for this new and sometimes risky procedure. For this assessment, direct measurement of left atrial and left ventricular pressures were necessary. A variety of techniques for access to the left side of the heart emerged in the early and mid-1950s. These involved percutaneous puncture—more or less blind—of the left atrium or ventricle and included advancing a needle into the suprasternal notch through the great vessels and (hopefully) the left atrium, and then passing a polyethylene catheter through the needle and into the left ventricle. Other approaches included a posterior transthoracic puncture of the left atrium, and transbronchial left atrial puncture by passing a needle

through a rigid bronchoscope. Measuring left ventricular pressure directly became critical when aortic valve surgery came along in the late 1950s and early 1960s. Needle puncture of the ventricle using a subxiphoid or apical approach were widely employed. All of these (and a few other) techniques were developed and carried out by cardiovascular surgeons. All were hazardous and some, especially transbronchial left heart catheterization, which was carried out through a rigid bronchoscope, were extremely uncomfortable for patients.

Our group of cardiologists and cardiovascular surgeons working in the intramural program of the National Heart Institute (now the Heart, Lung and Blood Institute) was deeply involved in the use of some of these techniques and recognized their deficiencies. In 1958, John Ross, a fellow trainee, stepped up to the plate and developed transseptal left heart catheterization (TSLHC) in experimental animals. One of the most thrilling events

in my professional life occurred in 1959, when I observed Ross carry out the first transseptal puncture of the left atrium in the Institute’s catheterization laboratory. Ross, Glenn Morrow (the Chief of Cardiac Surgery), and I knew that something very important had just occurred. Ross taught me how to manipulate the sheath and needle and soon we were in the “see one, do one, teach one” mode.

Following our early publications (see Figure P.1), cardiologists from across the world visited our catheterization laboratory to learn how to perform TSLHC. The technique proved to be relatively safe, it did not involve surgeons, the patients were not uncomfortable, and it allowed detailed assessment of left heart hemodynamics in patients who were in a steady basal state. In addition to facilitating cardiovascular diagnosis, we found that this approach was extremely useful in the conduct of physiologic and pharmacologic studies. By the mid-1960s, TSLHC had become the

dominant technique for measuring left heart pressures worldwide.

By the late 1960s, however, the picture changed again. Retrograde catheterization of the left ventricle became possible for cardiologists using the percutaneous Seldinger technique (named for the Swedish radiologist who developed this approach). As a consequence, the use of TSLHC declined as rapidly as it had grown only a decade earlier.

But TSLHC did not die, it merely hibernated for about two decades. It awoke in the late 1980s, when access to the left atrium again became of critical importance, this time to allow radiofrequency ablation of left-sided accessory pathways responsible for drug refractory supraventricular tachycardias. It really picked up steam in the 1990s when catheter ablation of atrial fibrillation became a reality. TSLHC became the preferred method of access to the left atrium and pulmonary veins in the cure of this common

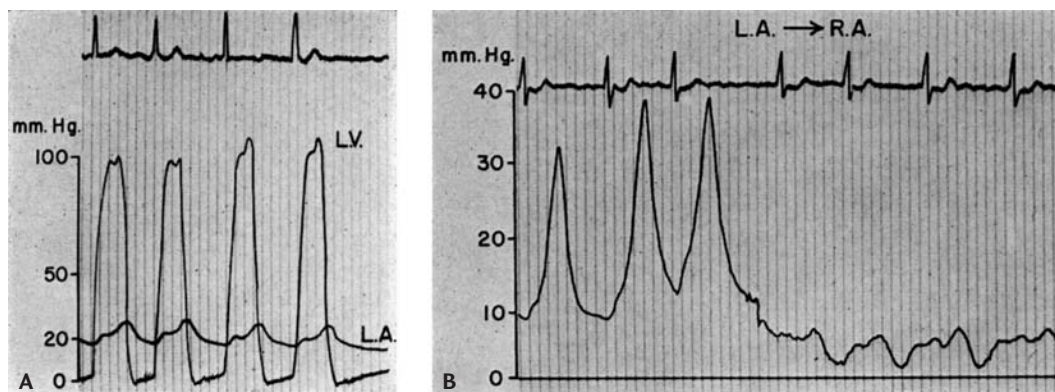


FIGURE P.1 **A.** Simultaneous left atrial and left ventricular pressures obtained in a patient with mitral stenosis and atrial fibrillation. The left atrial pressure was obtained by transseptal puncture and the left ventricular pressure by percutaneous puncture through the anterior chest wall. **B.** Pressure tracing obtained as the needle was withdrawn from the left atrium (L.A.) across the interatrial septum into the right atrium (R.A.) in a patient with mitral regurgitation. Ross J Jr, Braunwald E, Morrow AG. Transseptal left atrial puncture: new technique for the measurement of left atrial pressure in man. *Am J Cardiol* 1959;3:653-655.

arrhythmia. At present, TSLHC is being carried out for this indication far more frequently worldwide than it ever was during the 1960s.

What about the future of TSLHC? Just as it morphed from a diagnostic tool for the hemodynamicist into a therapeutic modality for the clinical cardiac electrophysiologist, it is again becoming important in the *treatment* of valvular heart disease. This also began in the 1980s—with balloon valvuloplasty for mitral stenosis. It is now expanding by allowing the insertion of a clip for the edge-to-edge repair of the valve leaflets in the treatment of mitral regurgitation. Clinical trials are being conducted to evaluate transseptal implantation of prosthetic aortic valves, as well as closure of the left atrial appendage. Another recent application is in percutaneous left ventricular assistance carried out by inserting a wide-bore catheter transseptally into the left atrium and pumping the blood so obtained into a cannula inserted into a systemic artery.

The technique of TSLHC has improved over the last half century, and it is now aided by transesophageal and intracardiac echocardiography. Surprisingly, the basic equipment—that is, the needle and sheath—is not much changed from what we used in the early days, except that it is now adapted for specific purposes. TSLHC is here to stay; it already plays an important role in the repertoire of both interventional cardiologists and clinical electrophysiologists, and it will play an increasingly important role in the future.

Transseptal Catheterization and Interventions is the first book on this subject. The editors, Drs. Thakur and Natale, as well as their talented authors, should be congratulated for providing such an excellent and eminently readable volume. The applications of this approach to the left side of the heart are growing, and both the technique and the equipment are evolving. I can't wait for the next edition.