

Contributed by R. Wayne Neal, M.D.-March, 2002

CARDIOLOGY IN THE TWENTIETH CENTURY-June 17, 1999

As the twentieth century draws to a close and as I retire from the practice of cardiology, I have been reflecting on the history of medicine, particularly on cardiology. I have listed some names and events which have come together to allow me to stand on the shoulders of many of my predecessors as I have evaluated and treated people with heart disease.

1867- A. W. Chase, M.D. published Dr. Chase's Recipes in 1867. His book points out the primitive way that he was treating illness. In his book he described "Toad ointment" for sprains, strains, lame-back rheumatism, caked udders and caked breasts. "Take good sized live toads, 4 in number-put into boiling water and cook very soft; then take them out and boil the water down to ½ pint, and add fresh churned, unsalted butter 1 lb. Simmer together. At the last, add tincture of arnica 2 oz. This was obtained from an old physician who thought more of it than of any other prescription in his possession. Some persons might think it hard on toads, but you could not kill them quicker in any other way."

1897- Sir William Osler, father of internal medicine stated that internal medicine embraced at least six specialties.

1900- Tools available to the physician to evaluate a patient with heart disease were the history, physical examination, and the stethoscope, with the treatment being mainly rest and a few oral medications.

1901- Dutch physiologist, Willem Einthoven, developed the string galvanometer and a year later it was used to record the electrical impulse of the heart.

1909- EKG's were performed in London Hospital by Sir Thomas Lewis.

1915- Medical school standards were raised as a result of Abraham Flexner's expose' of medical schools and John D. Rockefeller's endowment of medical schools that embraced ideology in research. Throughout the nation, physician owned medical schools closed and merged with universities, entrance requirements were raised, terms lengthened and curricula were standardized.

Physiologic principles studied in the scientists' laboratories were being applied in the physicians' offices.

Dr. James Herrick in Chicago first diagnosed an acute myocardial infarction using the EKG.

1920- For more than a generation, all the general physician needed to do to become a "heart doctor" was to purchase an EKG machine and attend a brief post-graduate course to learn how to use it. Early in this century another pathway to becoming a cardiologist was to go to Great Britain or Europe to work with a cardiologist, then return to this country to become an academic cardiologist. Dr. Paul Dudley White studied under Sir Thomas Lewis in London in 1913, after which he returned to Boston and became one of the world's leading cardiologists. I had occasion to see Dr. White on the boardwalk in Atlantic City in 1964.

Rehabilitation from heart disease and prevention of heart disease were being considered.

1924- The American Heart Association was incorporated. It has emphasized fund raising and research. It has also been very instrumental in greatly increasing public awareness and prevention of heart disease.

1929- An urology resident named Werner Forssmann performed the first heart catheterization on himself. He had hoped to find a better way to deliver medication into the heart during cardiac arrest. After inserting the catheter into his own basilic vein he walked to the x-ray department where a chest x-ray documented the catheter position.

1944- Johns Hopkins surgeon Alfred Blalock performed the Blalock-Taussig shunt on a "blue baby" with Tetralogy of Fallot. This procedure connects the subclavian artery, which normally goes to the arm, to the pulmonary artery. It results in delivery of more blood to the lungs, thereby increasing oxygenation of the blood. The baby's color and ability to be active are significantly improved. Dr. Denton Cooley, a surgical intern, assisted him and started to think that cardiac surgery was an important part of therapy for disorders of the heart.

1945- Johns Hopkins Hospital hired Dr. Richard Bing to establish the world's first diagnostic cardiac catheterization laboratory. Dr. Bing had fled Nazi Germany in 1933, along with many other prominent and promising scientists and clinicians. Among these were Drs. Pick and Langendorf, world-renowned cardiac arrhythmia experts, who escaped with their lives and library of electrocardiograms to come to Michael Reese Hospital in Chicago. I studied arrhythmia interpretation under them.

Dr. Lewis Dexter was also using the catheter to study human cardiac physiology.

1947- The first pulmonary valvotomy was performed by Dr. Holmes Sellers. Dr. Claude Beck, a heart surgeon, performed the first successful defibrillation on the exposed heart.

1948- Dr. Dwight Harken in Boston and Dr. Charles Bailey in Philadelphia successfully operated on patients with rheumatic mitral stenosis. I had the opportunity to visit with Dr. Harken at the ACC meeting in 1989 about the milestones of cardiovascular surgery.

Cardiology benefited from the National Heart Act of 1948 by paving the way for having formally trained cardiologists.

1949- The American College of Cardiology was incorporated. It has emphasized physician education. Both the American College of Cardiology and the American Heart Association publish practice guidelines and cardiology journals.

1954-The heart-lung machine was developed and allowed heart surgery to be performed on a non-beating heart.

1956- Dr. Paul Zoll defibrillated the heart through the chest wall.

1958- Dr. Mason Sones at the Cleveland Clinic invented selective coronary arteriography when he accidentally injected contrast medium into the right coronary instead of into the aortic root as he had planned. The patient was not harmed, thus telling Dr. Sones that one could safely photograph the coronary arteries. I visited Dr. Sones at the Cleveland Clinic in 1966 and observed coronary arteriography being performed.

I graduated from Washington University School of Medicine in St. Louis in 1958 and was an intern at The University of Chicago during the following year. Acute rheumatic fever was on the decline with the advent of penicillin, but rheumatic heart disease was still common. The mortality from heart surgery was high. Acute myocardial infarction was treated with a month or more of hospitalization, consisting of prolonged bed rest, morphine or Demerol for pain, and dicumarol. If heart failure developed, mercurhydrin, a weak diuretic, plus digitalis were given. If acute pulmonary edema developed, morphine, rotating tourniquets, oxygen and the sitting position were added. Quinidine was used for a tachyarrhythmia.

Because monitoring was not yet available, I once evaluated a patient who had syncope by having him connected to a direct writer EKG machine. When he fainted, his wife had been instructed to turn on the machine paper transport to record his electrocardiogram. Indeed, there was no cardiac electrical activity for several seconds, documenting the presence of a Stokes-Adams attack. No pacemaker had been developed and, unfortunately, there was no effective treatment for him.

During my internship, I drew all of the blood samples and did the admission CBC, UA and gram stains as indicated, for a salary of \$125 per month, from which \$25 was subtracted for health insurance and \$65 for rent. I was on call every other night, and got off around 11 p.m. on my night off. However, when working in the emergency room, I worked 36 hours and was off 12 hours.

The Director of Cardiology was Dr. Emmet Bay. He had studied with Dr. James Herrick, who first diagnosed an acute myocardial infarction with the EKG.

1961- Dr. Hughes Day established the first intensive coronary care unit in Bethany Hospital in Kansas City, Kansas. I visited with him in his hospital in 1967 and toured the original ICCU.

1962- I returned from three years of active duty as a medical officer in the Navy and began an internal medicine residency at the University of Chicago. Mortality from heart surgery was still moderately high. A coronary care unit was established there in approximately 1966.

1964- I was Chief Resident in Internal Medicine at the University of Chicago.

1965- President Lyndon Johnson's Commission on Heart Disease, Cancer and Stroke decried the "critical shortage" of formally trained cardiologists. This led to an increase in the number of federally funded cardiology fellowships. Medicare legislation was passed.

1965-1967- I was a cardiology fellow with Dr. Hans Hecht as Chief of Cardiology at the University of Chicago. The fluoroscopy unit in the cath lab was built by electronics and radiology technicians at the University of Chicago. The Director of the Cardiac Catheterization Lab was Dr. Murray Rabinowitz, who had studied with Dr. Lewis Dexter, a pioneer in cardiac catheterization. (see 1945).

1966- I became board certified in Internal Medicine.

1967- Dr. Christiaan Barnard performed the world's first heart transplant in South Africa.

1967-1968- I was Director of the Cardiac Catheterization Laboratory at the University of Chicago and was an Assistant Professor in the Department of Internal Medicine. In 1968, I became board certified in cardiovascular disease and a Fellow in the American College of Physicians.

1968- I became Director of Cardiovascular Services at St. John's Hospital. There was a cardiac catheterization laboratory in the Radiology Department. Heart catheterizations had been performed by Dr. C.S. Lewis and Dr. William Moore. The pressures were recorded by a Sanborn direct writer machine. The same machine was taken to the operating room where pressures were recorded during the heart operations. I made my catheters which were used for percutaneous insertion. This was done by placing a flexible wire through the catheter material, heating it over an alcohol burner until the material was soft, and pulling it out to a taper. The tapered end was then cut to fit snugly over the guide wire. The catheter was then inserted into the patient's artery or vein to measure pressures, take blood samples or inject contrast for purposes of taking an angiogram.

Sister Ursula (later she was Sister Johanna Renn) was the Administrator of the Radiology Department. She obtained approval from Sister Mary Edith, the Administrator, and Mr. Kenneth Wallace, the Assistant Administrator, to purchase excellent equipment for the catheterization laboratory. Sister Ursula called me while I was still in Chicago to tell me that she was not interested in spending a large sum of money for cath lab equipment unless I planned to stay at St. John's. I assured her that I planned to remain at St. John's. I brought Carl Moore, an electronics technician, to Chicago to learn to operate the "Electronics for Medicine physiologic recorder". Cam Gaylor, a laboratory technician, also came to Chicago to learn to perform blood oxygen measurements using the Van Slyke technique. Electronic arterial blood gas analyzers were not yet available.

After I came to St. John's Hospital, I performed adult and pediatric catheterizations in the laboratory, including Rashkind balloon septostomy. Some of our adult fellow citizens in Tulsa had cardiac catheterizations and balloon septostomy as infants in that laboratory. We also measured cardiac output and shunts with the oxygen analysis and with the dye technique. Resting and exercising physiologic studies were performed in the cath lab. It took a few years to upgrade the fluoroscopy unit until the catheterization laboratory was moved into the old chapel area to make room for the new tower facing 19th Street. We performed phonocardiograms on the patients with congenital and valvular heart disease. We also performed vectorcardiograms on some of the patients. Through the years, I have continued to see adults with congenital heart disease.

I was Medical Director of the cardiac catheterization laboratory from 1968 to 1971 and from 1977 to 1991. The cath lab is now one of the best in the Midwest, and is directed by Dr. Antonio de Leon Jr., who, also, is Director of the St. John Cardiovascular Institute. Sister M. Therese Gottschalk has been the Hospital Administrator from the inception of the St. John Cardiovascular Institute.

St. John Cardiovascular Institute has remained state of the art in all areas and a leader in some areas of cardiology.

A treadmill was purchased at St. John and replaced the "Masters two step test". The first test was performed on then medical student and now cardiovascular surgeon, Dr. Robert Hudson.

Dr. Homer Ruprecht and I conducted an EKG course for the house staff and students from 1968 until well into the 1970's.

1960's- Furosemide and ethacrynic acid, as well as beta-blockers, were developed. Lidocaine was first utilized for treating ventricular tachyarrhythmias. The implantable pacemaker was introduced. Bicycle and treadmill testing were introduced.

Late 1960's- Dr. Rene' Favalaro developed the coronary bypass operation at the Cleveland Clinic. I have met him and visited with him at the American College of Cardiology meetings.

Publications and papers presented:

R.W. Neal, Editor, The Housestaff Manual, University of Chicago Press, 1966.

R.W. Neal, presented paper at American College of Cardiology symposium at the University of Chicago, 1968- Aggressive Management of Coronary Artery Disease, Use of Pacing in Acute Myocardial Infarction.

I.L. Shapiro, B.M. Candiolo, R.W. Neal, and J.P. Petasnick: Pseudocoarctation of the Aorta; Archives of Internal Medicine, Vol. 122, October 1968, pp345-348.

R.W. Neal, K.G. Nair, and H.H. Hecht: A Pathophysiological Classification of Cor Pulmonale, with General Remarks on Therapy; Modern Concepts of Cardiovascular Disease, Vol. XXXVII, July 1968, pp. 107-112.

R.W. Neal, R.E. Falicov: Complex synchronized pacemaker (Atricor) malfunction; American Heart Journal, Vol. 78, No. 2, pp. 154-158.

R.W. Neal, Transseptal catheterization with the aid of a dilating catheter, American Heart Journal, Vol. 77, page 569, 1969.

J.J. Snipes, R.W. Neal: Conduction Abnormalities in the Presence of Acute, Myocardial Infarction, Oklahoma State Medical Association Journal, 1971

1969- I went to Houston and observed a coronary bypass operation performed by Dr. George Morris at the Methodist Hospital. I described my observations for Dr. Albert Shirkey, a cardiovascular surgeon, With his abilities and understanding as a surgeon, he began to successfully perform this operation. These, along with many other cardiovascular surgical procedures have been successfully performed at St. John Medical Center in subsequent years by Dr. Bill P. Loughridge, Dr. Robert Blankenship, Dr. Frank Fore, Dr. Robert Garrett and Dr. George Cohlma.

1970- I became a Fellow of the American College of Cardiology.

1971- Dr. Robert P. Zoller joined me. He was well trained as a clinical and invasive cardiologist. Dr. Charles Cooper also joined me in 1971 as a pediatric cardiologist.

1972- We entered the private practice of cardiology as Tulsa Cardiovascular Associates. Dr. Cooper moved to St. Francis Hospital in private practice in 1973.

1973- Dr. Richard D. Raines joined us and brought with him the ability to read echocardiograms as well as training in clinical and invasive cardiology.

1975- I was President of the Oklahoma Heart Association. We started the Heart Fund Sailing Regatta, which was an excellent fund raiser and a lot of fun. It was an annual event for the next 11 years.

1970's- I was President of the Tulsa Internists' Society and the Tulsa Chapter of the American Heart Association. The first Heart Ball was held that year in the Crystal Ballroom of the Mayo Hotel.

Dopamine, dobutamine, hydralazine, mitral valve repair and repair of Tetralogy of Fallot were developed.

1977- We were in the St. John Doctors' Building until 1977 when we built our office building at 4538 S. Harvard in Tulsa. We were in that building for 18 years.

Dr. Andreas Gruntzig developed balloon angioplasty, thus further developing therapeutic cardiac catheterization. He later came to Emory University in Atlanta where I attended several courses on this subject.

American College of Cardiology Heart House was dedicated in Bethesda, Maryland. The first learning center program was "The Bedside Art and Science of Cardiac Diagnosis," taught by Dr. Proctor Harvey and Dr. Antonio de Leon, Jr. of Georgetown University Medical School. Dr. Harvey has been a guest at St. John Medical Center on several occasions.

I was Chairman of the Department of Internal Medicine at St. John Medical Center.

1980's- The use of aspirin to treat coronary disease was introduced. Also the automatic implanted defibrillator and surgery for Wolff-Parkinson-White (WPW) were developed.

1987-I was appointed Clinical Professor of Medicine at the University of Oklahoma School of Health Sciences.

1987-1990- I was Governor for the State of Oklahoma for the American College of Cardiology.

1989-1990- I was Chairman of the Board of Governors for the American College of Cardiology.

1990's- Dr. Amjad Iqbal joined us as a nuclear cardiologist in the early 1990's and Dr. Robert Haas came a couple of years later with expertise as an interventional cardiologist. Tulsa Cardiovascular Associates merged with Dr. Jose' Medina, Dr. William Burnett, Dr. Stewart Katz and Dr. John Coyle in the mid 1990's to become Heart Center of Tulsa and moved to 21st and Xanthus. Dr. John Swartz has since joined our group as our cardiac electrophysiologist.

Coronary athrectomy and coronary stents have been introduced. Gene therapy is being introduced. Chemical structure of human genome is being determined with targeted completion of analysis being approximately 2003. IIb/IIIa platelet inhibitors have been introduced to inhibit thrombosis.

Cardiology has evolved into six different disciplines:

Invasive cardiologist: performs diagnostic cardiac catheterization and coronary angiography.

Noninvasive cardiologist: does not perform catheterization or coronary angiography; focuses on some combination of electrocardiography, echocardiography, nuclear cardiology, and stress testing.

Interventional cardiologist: performs therapeutic catheterization procedures such as percutaneous transluminal coronary angioplasty (PTCA) in addition to diagnostic cardiac catheterization and angiography.

Electrophysiologist: performs invasive (catheter-based) procedures to diagnose and treat complex heart rhythm disturbances. These procedures include radiofrequency ablation of an arrhythmia-causing site in the heart and insertion of permanent pacemakers and implantable defibrillators.

Preventive (or public health) cardiologist: focuses on some combination of cardiac rehabilitation, risk factor modification (especially cholesterol and lipid abnormalities), disease prevention, and epidemiology.

Molecular cardiologist: A new and evolving field using gene therapy to prevent or treat cardiovascular disease.

Although there have been tremendous advances in medicine in general and cardiology in particular, certain facts have not changed:

Clinical history and physical examination stand above technological advances.

All patients are equal and must be treated with respect, interest, compassion and optimism when at all possible.

When on call, the physician must be readily available to the patient.

Team effort is essential.

Respect for fellow physicians, particularly for the referring doctor and for the staff is essential.

Clinical teaching and research account for most of the progress in cardiology.

Prevention of cardiovascular disease is better than a cure.

The twentieth century has seen tremendous progress in medicine. During the same time, intellectual curiosity, ambition and money have also moved powered flight from the sand dunes of Kitty Hawk, NC in 1903 to the surface of the moon just 66 years later.

Progress in medicine has led to more demands for expertise and funds for patient care. Once it took only one doctor to resign himself and the child's parents to the inevitable death of a "blue baby." It now takes a team of medical specialists and auxiliary personnel to correct the congenital abnormality of a baby's heart to ensure the child a normal life span.

The recent federal effort to decrease the portion of the federal budget spent on health care has implications on the future of specialization in general and cardiology in particular. There is more reliance on the primary care physician and on prevention. Managed care programs have similar emphasis. Access to specialty care, when indicated, must remain an option. At the same time, it is the responsibility of the specialist and the patient to avoid overutilization of this care. In the next decade, we will witness a revolution in medicine, as gene therapy becomes a viable tool to prevent or treat a disease.

Heart Center of Tulsa and St. John Medical Center collaborate to deliver an outstanding level of care in treating and preventing cardiovascular disease. I believe this combination of experts will be a vital factor for cardiology in Tulsa well into the next millennium.

As I consider the strides, which have been made in the last century in cardiology and in our understanding of the heart, I know that that our understanding is still quite incomplete. I also know that hearts were following the same complex laws of physiology and biochemistry centuries ago as they do today, well before there was any understanding by humans about how the heart works.

I am reminded of Psalm 139, verses 13 through 16: "For you created my inmost being, you knit me together in my mother's womb. I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well. My frame was not hidden from you when I was made in the secret place. When I was woven together in the depths of the earth, your eyes saw my unformed body. All the days ordained for me were written in your book before one of them came to be."

I am grateful for God's guidance throughout my life. I am confident that He has ordered my steps throughout my career. Psalm 37:23 states it well: "If the Lord delights in a man's way, he makes his steps firm; though he stumble, he will not fall, for the Lord upholds him with his hand."

R. Wayne Neal, M.D.
June 17, 1999