Management of Cardiovascular Issues

50 Years (or so)

Mended Hearts of Central Ohio August 19,2015

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Improving People's Lives
through innovations in personalized health care

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

"50 Years"

- Amazing developments would take 50 years to describe
- Related to my time in medicine:
  - Medical school September 1961
  - Residency July 1, 1965
  - US Air Force1967-69
  - Joined OSU Faculty Division of Cardiology
    July 1, 1972

“50 Years”

What happened 50 years ago?

“50 Years”

What happened 50 years ago?

July 30, 1965

President Lyndon B. Johnson made Medicare law by signing H.R. 6675 in Independence, Missouri.

Former President Truman was issued the very first Medicare card during the ceremony.

“50 Years”

What happened 50 years ago?

On **July 30, 1965** President Lyndon B. Johnson made Medicare law by signing H.R. 6675 in Independence, Missouri.

1915: Originally formed in New York City in as the Association for the Prevention and Relief of Heart Disease**, the American Heart Association** was established in 1924

1930: NIH 1967: Division of Regional Medical Programs created to administer grants for research for heart disease, cancer, and strokes.

1948: (June 16) Truman signed National Heart Act creating what is now NHLBI

1949: The American College of Cardiology was chartered and incorporated as a teaching institution.

“50 Years”

CAB career decision 1967

Faculty mentor (nephrologist):

FM: “What are you going to do when you get back from Air Force?”

CAB: “Probably Cardiology”

FM: “Why do you want to do that? All there is in cardiology is coronary disease. We already know everything there is to know about it and we can’t do anything for it.”

“50 Years”

My cardiology fellowship focused on valve disease with research emphasis on Left Ventricular Function and diagnostic heart catheterization. Performed multiple studies on validation of diagnostic techniques.

Of note: I did NOT perform a selective coronary angiogram until I was a faculty member in 1972

"50 Years"

When I started in cardiology the diagnostic tools were:

- Electrocardiogram (ECG or EKG)
  - 1895 Willem Einthoven labels ECG waves
- Stethoscope
  - 1816 Laennec invents stethoscope
- Chest x-ray (cardiac fluoroscopy)
  - 1895 William Roentgen discovers x-rays
- Sphygmomanometer (BP cuff)
  - 1881 von Basch 1902 Harvey Cushing
- Cardiac Catheterization (just beginning)

“50 Years”

History of the Electrocardiogram

1838

Carlo Matteucci, Professor of Physics at the University of Pisa shows that an electric current accompanies each heart beat. He used a preparation known as a 'rheoscopic frog' in which the cut nerve of a frog's leg was used as the electical sensor and twitching of the muscle was used as the visual sign of electrical activity.

“50 Years”

History of the Electrocardiogram

1895 Einthoven, using an improved electrometer and a correction formula developed independently of Burch, distinguishes five deflections which he names P, Q, R, S and T.

1902 Einthoven publishes the first electrocardiogram recorded on a string galvanometer.

1905 Einthoven starts transmitting electrocardiograms from the hospital to his laboratory 1.5 km away via telephone cables.

OSU connection: Dr Stephen Schaal, John Robinson, Joe Ryan

“50 Years”

History of the Electrocardiogram

1932 Goldhammer and Scherf propose the use of the electrocardiogram after moderate exercise as an aid to the diagnosis of coronary insufficiency.

1935 Master’s “2 step” 1958-62 during exercise

1949 Montana physician Norman Jeff Holter develops a 75 pound backpack that can record the ECG of the wearer and transmit the signal.

“50 Years”

History of the Electrocardiogram

1963

Robert Bruce and colleages describe their multistage treadmill exercise test later known as the Bruce Protocol. "You would never buy a used car without taking it out for a drive and seeing how the engine performed while it was running," Bruce says, "and the same is true for evaluating the function of the heart."

“50 Years”

History of the Stethoscope

Laennec’s Baton: (1816)

I rolled a quire of paper into a sort of cylinder and applied one end of it to the region of the heart and the other to my ear, and was not a little surprised and pleased, to find that I could thereby perceive the action of the heart in a manner much more clear and distinct than I had even been able to do by the immediate application of the ear.

“50 Years”

History of the Stethoscope

Laennec would call this instrument a ‘stethoscope’, from the Greek words meaning ‘I see’ and ‘the chest’.

“50 Years”

History of the Stethoscope

Stethoscopes are often considered as a symbol of healthcare professionals, as various healthcare providers are often seen or depicted with stethoscopes hanging around their necks. *A 2012 research study demonstrated that among several icons of healthcare, the stethoscope had the highest positive impact on the perceived trustworthiness of the practitioner*

OSU connection: Drs. Charles Wooley, Mary Fontana, Joseph Ryan

“50 Years”

CCU

The first description of a CCU was given in 1961 to the British Thoracic Society by Dr. Desmond Julian, who founded the first CCU at the Royal Infirmary of Edinburgh.

The first coronary care unit in the US was opened at Bethany Medical Center in Kansas City, Kansas by Dr Hughes Day in 1964.

Intensive care for myocardial infarction. In 1967, Thomas Killip and John Kimball published a report of 250 patients with acute MI’s, who had experienced significantly better survival rates in CCUs compared to other institutions

OSU connection: 1st CCU in Ohio at OSU Hospitals 1964

Drs. James Warren, Richard Lewis, John Robinson

“50 Years”

Cardio Pulmonary Resuscitation (CPR)

In August 1767 a few wealthy and civic-minded citizens in Amsterdam gathered to form the Society for Recovery of Drowned Persons. This society was the first organised effort to respond to sudden death. The society's techniques involved a range of methods to stimulate the body. The members of the society recommended:

- warming the victim;
- removing swallowed or aspirated water by positioning the victim's head lower than feet;
- applying manual pressure to the abdomen;
- respirations into the victim's mouth, either using a bellows or with a mouth-to-mouth method;
- tickling the victim's throat;
- 'stimulating' the victim by such means as rectal and oral fumigation with tobacco smoke; bellows were used to drive tobacco smoke, a known irritant, into the intestine through the anus, as this was thought to be enough of a stimulant to engender a response in the “almost” dead; and
- bloodletting.

“50 Years”

Cardio Pulmonary Resuscitation (CPR)

DF Beck performed the first successful resuscitation of a physician with myocardial infarction in 1953, and pioneered the use of open-chest defibrillation. Dr. Zoll introduced external defibrillation in Boston in 1956, and Dr. Kouwenhoven and colleagues at Johns Hopkins highlighted the effectiveness of a combo of mouth-to-mouth, sternal compression, and closed chest defibrillation in restoring cardiac function in ventricular fibrillation patients

In 1954, James Elam was the first to demonstrate experimentally that cardiopulmonary resuscitation (CPR) was a sound technique and, with Dr. Peter Safar, he demonstrated its superiority to previous methods. Peter Safar wrote the book *ABC of resuscitation* in 1957. In the United States, it was first promoted as a technique for the public to learn in the 1970s.

2002: Targeted hypothemia

“50 Years”

CPR

CPR has continued to advance, with recent developments including an emphasis on constant, rapid heart stimulation, without respiration. Studies have shown that people who had rapid, constant hands-only chest compression 22% more likely to survive than those receiving conventional, CPR that included breathing. What's more, because people tend to be reluctant to do mouth-to-mouth, chest-only CPR nearly doubles the chances of survival overall, by increasing the odds of receiving CPR in the first place.

“50 Years”

Heart Imaging Modalities

Echocardiogram

The original description of M-mode echocardiography in **1953**, by Inge Edler and his physicist friend Hellmuth Hertz. The technique was primarily for the preoperative study of mitral stenosis and diagnosis of mitral regurgitation. Also the imaging of choice for pericardial effusion.

Harvey Feigenbaum collaborated in **1968** with Harold Dodge at the University of Alabama, whose laboratory at that time had the greatest expertise in measuring angiographic volumes. Together, Feigenbaum and Dodge applied the M-mode technique to the measurement of ventricular dimensions—an M-mode echocardiogram is not a “picture” of the heart: it was a diagram that showed how the position of its structures changed during the course of the cardiac cycle.[34]

In the early **1970s**, Reggie Eggleton[35] put a Sunbeam® electronic toothbrush to an innovative use and gave the world its 1st commercially successful 2-dimensional echocardiogram, which enabled the visualization of actual images of the heart. In **1973,** S.L. Johnson,[36] with an engineer friend, combined 2-dimensional with pulsed Doppler imaging to enable the detection of flow signals from specific locations within the heart or great vessels; thus was born duplex scanning.

OSU connection Tom Ryan, MD

“50 Years”

Heart Imaging Modalities

Computed Tomography (CT, CTA) 1972

- concern for radiation exposure
- pulmonary embolic disease

Nuclear Magnetic Resonance (NMR) 1973

- medical imaging 1977
- renamed to MRI in1984

“50 Years”

Heart Imaging Modalities

Cardiac MRI has evolved to CMR (cardiovascular magnetic resonance)

SCMR 1996

JCMR 1999

OSU connection: Subha Raman, MD

"50 Years"

Cardiovascular Pharmacology

1960: digitalis, mercuhydrin, atropine, epinephrine, isoproterenol, nitroglycerin

1964: beta-blockers (propranolol)

Dobutamine, ACE inhibitors, diuretics, antiarrhythmics

OSU connection: Dr. Carl Leier

“50 Years”

Heart Failure

“Dropsy” edema / ascites

cardio – renal origin

1785 William Withering: monograph on foxglove (digitalis) for remedy of dropsy

Digitalis – weak inotrope

Diuretics – mercuhydrin, eventually HCTZ

Oxygen

Bedrest

“50 Years”

Heart Failure

Systolic vs diastolic heart failure

Pharmacology:

- beta blockers, diuretics, vasodilators, ACE inhibitors, inotropes

Biventricular pacing, CRT

Intraaortic balloon pump

Venricular assist devices

OSU connection : Drs. Carl Leier, William Abraham

“50 Years”

Electrophysiology

Pacemakers:

In 1889, John Alexander MacWilliam reported in the *British Medical Journal* (BMJ) of his experiments in which application of an electrical impulse to the human heart in asystole caused a ventricular contraction and that a heart rhythm of 60–70 beats per minute could be evoked by impulses applied at spacings equal to 60–70/minute.[1]

In 1926, Dr Mark C Lidwill of the Royal Prince Alfred Hospital of Sydney, supported by physicist Edgar H. Booth of the University of Sydney, devised a portable apparatus which "plugged into a lighting point" and in which "One pole was applied to a skin pad soaked in strong salt solution" while the other pole "consisted of a needle insulated except at its point, and was plunged into the appropriate cardiac chamber".

In 1932, American physiologist Albert Hyman, working independently, described an electro-mechanical instrument of his own, powered by a spring-wound hand-cranked motor.

“50 Years”

Electrophysiology

Pacemakers:

An apparent hiatus in publication of research conducted between the early 1930s and World War II may be attributed to the public perception of interfering with nature by "reviving the dead". For example, "Hyman did not publish data on the use of his pacemaker in humans because of adverse publicity, both among his fellow physicians, and due to newspaper reporting at the time. Lidwell may have been aware of this and did not proceed with his experiments in humans

“50 Years”

Electrophysiology

Pacemakers: By 1966, 56 patients had undergone implantation with one surviving for over 5½ years.

Lithium battery 1972

Leadless pacemakers 2014

Defibrillator / Cardioversion 1962

ICD’s 1980

AED’s 1998-2002

OSU connection: Drs. Charles Meckstroth, Charles Love

“50 Years”

Electrophysiology

OSU connection: Dr. Stephen Schaal

Ablation for atrial fibrillation

- Cox-Maze surgery 1987
- Catheter based ablation

VT ablation

Pathway ablation (WPW, SVT)

AV node ablation with pacemaker implant

OSU connection: Drs Emile Daoud, Ralph Augostini

“50 Years”

Coronary Artery Disease -- Angina

Acute Myocardial Infarction

1772 William Heberden: publishes classic description of angina pectoris

1912 James Herrick: publishes classic description of acute myocardial infarction

“50 Years”

Acute Myocardial Infarction

STEMI

Dwight David Eisenhower had a left anterior myocardial infarction in **September 1955**, while on vacation at his in-laws' house in Denver. He was transported by car to Fitzsimmons Veterans Hospital and placed in an oxygen tent. His EKG showed ventricular and supraventricular premature beats. Although he developed a friction rub, he was treated with heparin. Eisenhower's long term treatment included coumadin 35 mg/wk, a low fat diet, and maintenance of weight at 175 pounds.

The pace of Eisenhower's recovery from his infarction was slow by today's standards, (but for the time was remarkably aggressive.) In 1955, patients with a myocardial infarction were routinely kept in bed for 6 months afterwards. Dr. Paul Dudley White was criticized by his contemporaries for mobilizing the President so quickly. In retrospect, Eisenhower's "rapid" recovery after his infarction changed the way infarct patients were treated.

“50 Years”

Acute Myocardial Infarction

Date (1955)	Event
September 24	Infarct. Bedrest prescribed.
October 11	First allowed to see a cabinet member.
October 22	Sitting up in a chair for a few hours each day, and holding daily conferences about his presidential duties.
November 7	Walking and starting to climb stairs.
November 11	Returned to Washington, the trip delayed a month so that Eisenhower would not be seen being wheeled to the airplane and being lifted on board. After landing in Washington, goes to his farm in Gettysburg, Pennsylvania.

“50 Years”

Pre-hospital treatment

In 1965, Frank Pantridge turned his attention to this vexing problem of heart attacks and sudden cardiac death. Pantridge's solution was to develop the world's first mobile coronary-care unit, or MCCU. He staffed it with an ambulance driver, a physician, and a nurse.

The National Highway Safety and Traffic Act of 1966 authorized the Department of Transportation to establish a national curriculum for prehospital personnel, which led to the training of emergency medical technicians (EMTs).

1968 William Grace, M.D., and the St. Vincent 's Hospital and Medical Center of New York initiated the Nation’s first mobile coronary care unit. In 1967, the United States Public Health Service estimated that there were approximately a half-million acute myocardial infarction deaths in the United States annually with at least 50% to 75% of these patients dying before receiving medical attention at a hospital.

“50 Years”

Pre-hospital treatment

OSU connection:

Doctors James Warren and Richard Lewis of Ohio State University Hospitals were following the efforts of Dr. Pantridge in mobile coronary care. With the assistance of a 1968 Federal Highway Grant awarded to Columbus, Seattle and Los Angeles, they began to develop a plan to provide mobile coronary care to the citizens of Columbus.

The result was the Heartmobile, the first vehicle specifically designed as a Mobile Coronary Care Unit in the United States. The Heartmobile was designed and built locally, and was staffed by three specially trained Columbus Firefighters and an Ohio State University Hospital physician. The Columbus Fire Department was chosen as the source for the newly created ‘paramedics’, based on its existing EMS system and the more than 30 years of experience in providing pre-hospital medical care.

“50 Years”

Pre-hospital treatment

“50 Years”

Pre-hospital treatment

The Heartmobile is credited with the successful beginnings of onsite resuscitation of cardiac arrest and heart attack patients. It was soon apparent that firefighters were capable of providing advanced medical care with out the direct supervision of a physician. On July 1, 1971, the Heartmobile was incorporated into the Columbus Division of Fire Emergency Squad system. Today the highly trained paramedics in Columbus and across the nation operate without direct physician supervision as a direct result of the Heartmobile and similar programs across the country.

"50 Years"

STEMI

1979 Rentrop: Intracoronary NTG and streptokinase

1981 Ganz / Buchbender: IC / IV thrombolytic therapy for AMI

1997-2003 Primary PCI for STEMI

door to balloon time

symptom to balloon time

OSU connection: Ray Magorien TIMI trials

Drs Ernest Mazzaferri, Vincent Pompili

“50 Years”

Cardiac Catheterization

1711 Hales: put catheters in RV and LV of living horse

1840 Claude Bernard: formal study of cardiac physiology

1927 Cerebral angiography

1929 Werner Forssman: right heart catheterization on himself

1940 Cournand / Richards: hemodynamics

1945 Diagnostic cardiac catheterization lab at Johns Hopkins

1953 Seldinger: catheter access via needle

1959 Mason Sones: selective coronary angiography

OSU connections: Drs Charles Wooley, Mary Fontana, Charles Bush

"50 Years"

Cardiac Catheterization

- 1958 Charles Dotter: peripheral angio and reopening closed vessels
- 1964 Dotter: peripheral balloon angioplasty
- 1967-68 Melvin Judkins: shaped catheters for selective vessel cannulation
- 1977 Gruentzig: Balloon angioplasty of coronary artery
- 1985-87: Puel / Sigwart, Palmaz, Schatz stents for PCI collapse
- 2001: Drug eluting stents
- 2010: Bioabsorbable stents

OSU connection : Jim Warren 1st to cross an ASD during heart catheterization
Drs. Barry George, Ernest Mazzaferri, Vince Pompili, Ray Magorien for PCI

“50 Years”

Cardiac Catheterization

Stent / Stenting

The current acceptable origin of the word *stent* is that it derives from the name of a dentist. Charles Thomas Stent (1807 to 1885) was an English dentist notable for his advances in the field of denture-making.

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

- *09/09/1896 heart surgery was founded: L. Rehn successfully closed a heart stab wound by means of a direct suture. The first methods were developed on the beating heart.*
- *1912 Aortic Valve dilatation*
- *1918 Pericardial resection*
- *1923 Mitral Valve dilatation*
- *1924 Pulmonary Embolectomy*
- *1931 RV aneurysmectomy*
- *1944-45 Dwight Harkin: shell fragments removed from 134 patients*

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

Valve Surgery:

1946-48 Commissurotomy on aortic, mitral and pulmonic valves

1960-61 Aortic / mitral valve replacement

Starr-Edwards valve

Dwight Harkin MD (founder of Mended Hearts)

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

Coronary Surgery

1935 Beck I: pectoral muscle implanted in pericardium; talcum powder in pericardial space

1947 Beck II: Vein graft from aorta to coronary sinus

1950 Vineberg: direct mammary artery implant

1960-64: LIMA graft to coronary artery

1968 Favaloro: saphenous vein graft procedure

"50 Years"

Cardiac Surgery

The History of Cardiac Surgery

Coronary Surgery (continued)

- Refinements:
  - total arterial revascularization
  - Transmyocardial laser revascularization

1967 Cardiac Transplantation

1967 Barnard (South Africa)

1968 Shumway (USA)

1980's Cyclosporin for rejection

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

Congenital Heart Disease

(1938) PDA ligation, **(1944)** Coarctation,

(1944) shunts(Blalock-Taussig) **(1952)** ASD repair,

Support systems

1960 Pump-oxygenator

1952 Hypothermia

1973-81 Cardioplegia

1953 (1960’s) Cardiopulmonary bypass – heartlung machine

1954 Controlled cross-circulation

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

- Beating Heart Surgery
- Minimally invasive surgery
- Ventricular assist devices
- ECMO

“50 Years”

Cardiac Surgery

The History of Cardiac Surgery

- LV aneurysmectomy
- Post MI VSD repair
- Arrhythmia surgery

“50 Years”

Heart Hospitals

England: The National Heart Hospital was founded in 1857 in Margaret Street by Dr Eldridge Spratt. The hospital was relocated to Newman Street off Oxford Street around 1869 and then to Soho Square in 1874, with various changes of name en route, including in 1872

"**The National Hospital for the special treatment of Paralysis, Epilepsy, Nervousness, and the Primary Stages of Insanity and other diseases from Affectations of the Heart."**

“50 Years”

Heart Hospitals

OSU connection:

2004 Richard M. Ross Heart Hospital

One of the first academic heart and vascular hospitals in the US

Built for the future of cardiovascular medicine and surgery

“50 Years”

Current / Future

- Total artificial heart
- Transcatheter Valve repair / replacement
  - TAVR
  - Mitral Clip
- Myocardial regeneration (stem cell Rx)
- Cardiac genetics
- ??????????????????????????

“50 Years”

Thank You

Management of Cardiovascular Issues

50 Years (or so)

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