

Special Article

John W Kirklin: The Greatest Scientific Cardiac Surgeon of the Century

Md. Anisuzzaman¹, Nazmul Hosain²

Department of Cardiac Surgery, Chittagong Medical College, Chittagong, Bangladesh

Abstract:

Key words:
Kirklin, Cardiac
Surgery.

John Webster Kirklin was an American cardiothoracic surgeon, prolific author and medical educator who is best remembered for refining John Gibbon's heart-lung bypass machine via a pump-oxygenator to make feasible under direct vision routine open-heart surgery. His other advances, on which success of heart surgeries depends, including teamwork, developments in establishing the correct diagnosis before surgery and progress in computerized intensive care unit monitoring after open heart surgery. Wayne Miller refers to Dr Kirklin in the 1970s as "arguably the best practicing open heart surgeon anywhere. He was one of cardiac surgery's most accomplished researchers, a scientist whose mind was sometimes compared, flatteringly, to a computer." John W Kirklin and Brian G Barratt-Boyes drafted the book 'Cardiac Surgery', which is considered as the Bible of the subject.

(Cardiovasc j 2021; 14(1): 93-96)

Introduction

A textbook written by an American and a New Zealander is a definite collection in the bookshelf of any cardiac surgeons. John W Kirklin and Brian G Barratt-Boyes drafted the book 'Cardiac Surgery',¹ which is considered as the Bible of the subject. John Kirklin is one of the pioneers of the early days of cardiac surgery. He played the major role in the practical and clinical utilization of the heart lung machine invented by John Gibbon. He was one of cardiac surgery's most accomplished researchers till date.

John Kirklin was born on 5th August, 1917, in Muncie, Indiana, USA. His family moved to Rochester, Minnesota when he was 10, as his father Dr. Byrl R. Kirklin was recruited to the Mayo Clinic as their first Director of Radiology. His father eventually became Professor of Radiology there and served as the President of the American Roentgen Ray Society in 1937. John Kirklin was the student manager of the Golden Gophers University football team during his undergraduate

years at the University of Minnesota and. He then graduated from Harvard Medical School as the first in his class of 150 and was awarded the degree of MD, Magna Cum Laude.¹ Dr. Elliott Cutler, Professor and Chairman of the Department of Surgery at the time, wrote, "This is the brightest medical student I have ever seen." Dr. Kirklin did an internship at the University of Pennsylvania from July 1942 through April 1943.²

He started his residency at the Mayo Clinic in April 1943 and continued till June 1944. He was inducted into the Army in July 1944 as a medical officer. Three months later, he received training in neurosurgery and continued serving in that specialty throughout his military tour, which lasted until August 1946. Dr. Kirklin finally completed his surgical training at the Mayo Clinic in October 1950 and remained there as a surgeon. He had also spent 6 months under Dr. Robert E. Gross at the Children's Hospital, Boston, Massachusetts, from July 1948 until January 1949.

Address of Correspondence: Dr Nazmul Hosain, Department of Cardiac Surgery, Chittagong Medical College & Hospital, Chattagram, Bangladesh. Email: heartsurgeon007@gmail.com.

© 2020 authors; licensed and published by International Society of Cardiovascular Ultrasound, Bangladesh Chapter and Bangladesh Society of Geriatric Cardiology. This is an Open Access article distributed under the terms of the CC BY NC 4.0 (<https://creativecommons.org/licenses/by-nc/4.0>)



Fig.-1: *John W. Kirklin in Mayo Clinic.*

Interest in Cardiothoracic Surgery

Dr. Kirklin developed interest in cardiac surgery during his freshman year at Harvard Medical School. He was inspired after attending a lecture by Dr. Robert E. Gross. Dr. Gross was the first surgeon to successfully close a patent ductus arteriosus on a seven-year-old girl named Lorraine Sweeney at Children's Hospital Boston in 1938. Dr. Kirklin recalled that event later and fill up notebooks "about how we would fix the inside of a heart if we could get there. We couldn't, of course, but being young, you dream!"³

In the 1950s Minnesota became the cradle of cardiac surgery⁴. Famous surgeons were contributing in the future development of cardiac surgery there in those days. They include Owen Wangesteen, Walton Lillehei, John Lewis, Richard Varco, Norman Shumway, Christiaan Barnard, Christian Cabrol and others. Various research activities including controlled cross circulation, surface hypothermia and inflow occlusion techniques were being deployed to overcome the barriers of open-heart surgery. In 1952, while serving at the Mayo Clinic, John Kirklin decided to pursue research on the development of a heart-lung machine. He investigated and visited the groups working intensely with mechanical pump-oxygenators, which included John Gibbon in Philadelphia and Forest Dodrill in Detroit, among others. After these visits, he managed to persuade the management of the Mayo Clinic to let him build a pump-oxygenator similar to the Gibbon machine, but somewhat different. By the winter of 1954-55,

he had notable success, when 9 out of his 10 experimental dogs survived cardiopulmonary bypass runs. His team decided that they were ready to apply this technique for intracardiac repair in humans. Eight children were selected and this clinical trial was approved by Mayo Clinic authority. The first case was a ventricular septal defect closure and was performed successfully in March 1955. Four of the first eight patients operated by Kirklin and his team survived.⁵ Kirklin is thus often described as the first to perform a successful series of open-heart operations using heart-lung machine.

Four months after the publication of the first Mayo Clinic series of surgeries using cardiopulmonary bypass, Walton Lillehei at the University of Minnesota abandoned the controlled cross circulation technique and started using the DeWall pump, a bubble oxygenator-based device developed at the University. Reflecting on this era, Norman Shumway of Stanford later remarked, "There for a shining moment the only institutions in the world where one could go for open heart surgery were 90 miles apart, at the Mayo Clinic and the University of Minnesota."

This was a very difficult time of developmental work. Dr. Alberto D Pacifico, a longtime associate of Dr. Kirklin and later the Chief of Cardiothoracic Surgery at the University of Alabama, Birmingham (UAB) commented on him during that early period. "Can you imagine going to work and having somebody die on you every third day? I think it takes a very extraordinary person who can withstand that and make something positive of it."⁶ His surgical results gradually improved during that year and the years to follow.



Fig.-2: *Mayo Clinic, Rochester, Minnesota.*

With the advent of techniques to support the circulation and oxygenate the blood, using either the crossed circulation technique of Dr. C W Lillehei or the modified Gibbon-IBM heart-lung machine of Dr. John Kirklin, the cardiac teams of the University of Minnesota and the Mayo Clinic led the way and did many of the first intracardiac repairs for a number of commonly occurring congenital heart defects.⁷

Varying in style and character, two legendary surgeons of the day Lillehei and Kirklin worked only 90 miles apart. During the 1950s and 1960s, the trend of ambitious trainee cardiac surgeons was to fly to Minneapolis to observe Lillehei and subsequently travel to the Mayo Clinic to then watch Kirklin.

During the early days of cardiac surgery, failure was usually the result diagnostic errors and limited understanding of the anatomy and pathophysiology of the congenital heart defects. Under Kirklin's leadership, various innovations contributing to correct preoperative diagnosis and computerized intensive care unit monitoring improved success in open heart surgery.

Dr. Kirklin was promoted to Professor of Surgery in July 1960. From January 1964 through September 1966, he served as the Chairman of the Department of Surgery at the Mayo Clinic and Mayo Graduate School of Medicine.

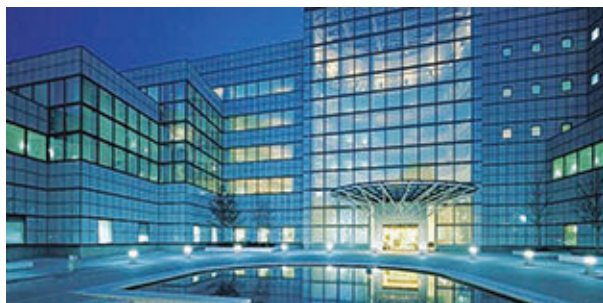


Fig.-3: *The Kirklin Clinic of UAB Hospital- School of Medicine.*

After a successful tenure at the Mayo Clinic, Kirklin accepted to move south to the University of Alabama School of Medicine (Fig-3) as the Chairman of the Department of Surgery in 1966, succeeding Champ Lyons.^{8,9} Besides having his heart surgery service at the University Hospital, he also had a general and vascular surgery service

at the Veterans Hospital. As part of the conservative deep south, Alabama is one of the most backward states of USA. In the 1960s it was notorious for racial violence, intolerance and oppression against the followers of Martin Luther King Jr. John Kirklin later recounted that he felt it would be easier to develop a department of surgery and the training of surgeons in Birmingham.¹⁰ He built the school and UAB Hospital system into one of the leaders in the health care industry. UAB later named its Kirklin Clinic in his honor. He generally called people by their proper names. His speech was articulate. He had command of a significant vocabulary, but generally did not display its extent except when appropriate or when sensing that he was being tested or challenged. He was a very strict taskmaster. Many of the surgical faculty emulated him in one way or another, but rarely did any of them challenge him. He continued to operate as a cardiac surgeon and kept the title of Chief of the Division of Cardiothoracic Surgery until about the age of 70. In 1989, at the age of 72, he stopped operating, but remained active with computers, patient information systems, and medical records at UAB. In about 2000, he stopped coming in to work. During the UAB attachment in 2003, the corresponding author of this article had listened many incidents concerning John Kirklin from AD Pacifico (Fig 4), James Kirklin and other faculty members of UAB.

John Kirklin was also served as the editor for *The Journal of Thoracic and Cardiovascular Surgery*.¹¹ In addition, Kirklin developed the use of technology for continuous monitoring of vital functions in the intensive care unit.¹²

The Legacy

Famous cardiothoracic surgeon Michael E. DeBakey commented about Kirklin: "It was the clinical application of the heart-lung machine that made John Kirklin one of the world's pioneers in modern heart surgery."¹³ In addition, Dr. Kirklin's legacy includes many contributions in operative techniques, patient care, and better understanding of the pathophysiology of cardiopulmonary bypass. He has given us a current standard textbook in cardiac surgery.¹ He trained and directed the training of several generations of surgeons, including his son, Jim, Professor and chief of Cardiothoracic Surgery at UAB. He was more responsible than anyone else for putting UAB on

the national and world map as a place to obtain first-class medical care. He published results of various operations often set the bar at a new height for others to obtain or surpass. Perhaps his biggest contribution was to bring law, order, discipline, and science to this new emerging field of medicine.

Currently an estimated 1 million cardiac operations are performed each year worldwide with the use of the heart-lung machine. In most cases, the operative mortality is quite low, approaching 1% for some operations. Little thought is given to the pioneers who made all of this possible. I believe we have witnessed the passing of a giant. Dr. Kirklin's response would probably be, "There are imprecisions lurking in such a superlative."¹⁴

Awards and honors

Among the awards and honors that Kirklin received are, Elected honorary FRCS England in 1970, The Lister Medal 1972, for his contributions to surgical science. The corresponding Lister Oration, given at the Royal College of Surgeons of England, was delivered on 11 April 1973, and was titled 'An Academic Surgeon's Work'. The American Heart Association Research Achievement Award, 1976, The Ray C. Fish Award (the medal of the Texas Heart Institute) 1977, The Rodolph Matas Award in Vascular Surgery, The Rene Leriche Prize of the International Society of Surgery and the American Surgical Association Medallion for Scientific Achievement.



Fig.-4: The photograph features corresponding author of this article with Dr. A D Pacifico while attending as a WHO Fellow at the Kirklin's Dept. of Cardiac Surgery, University of Alabama at Birmingham (UAB), USA in 2003.

Between 1978 and 1979, he was president of the American Association for Thoracic Surgery. In addition, he received honorary degrees from a number of universities including the University of Munich, UAB, Indiana University, University of Bordeaux and the University of Marseille.¹⁵

Kirklin had more than 700 publications to his name in addition to the textbook 'Cardiac Surgery', he authored with his colleague Brian Barret-Boyes.

Conflict of Interest - None.

References:

1. Kouchoukos NT, Blackstone EH, Doty DB, Hanley FL, Karp RB. *Kirklin/Barratt-Boyes cardiac surgery*. 3rd ed. Churchill Livingstone, Philadelphia 2003.
2. Gross RE. Introduction of the Caldwell Lecture, 1967. *Am J Roentgenol Radium Ther Nucl Med* 1968; 102: 251-252.
3. Stephenson LW, Rodengen JL. John Kirklin's inspiration: how we would fix the inside of the heart. In: State of the heart: *The practical guide to your heart and heart surgery*. Write Stuff Enterprises, Fort Lauderdale [FL] 1999: 24-25.
4. Hosain N, Amin F, LePrince P. A Tribute to pioneer cardiac surgeon Christian Cabrol 1 year after his death, on the 50th Anniversary of the First European Human Heart Transplantation that he performed in 1968. *Eur Heart J* 2018; 39: 1661-1671. DOI:10.1093/eurheartj/ehy195.
5. Kirklin J. The middle 1950s and C. Walton Lillehei. *J Thorac Cardiovasc Surg*. 1989; 98(5): 822-824. DOI:10.1016/s0022-5223(19)34259-x
6. Velasco A. Pioneer in heart surgery dies at 86. *Birmingham News*. 2004.
7. Stephenso LW. History of cardiac surgery. In: Cohn LH, Edmunds Jr. LH. Eds. *Heart surgery in the adult*. 2nd ed. New York: McGraw-Hill Medical Publishing Division, 2003: 15.
8. Cooley D. John W. Kirklin, MD. *Circulation*. 2004; 109(24): 2928-2929. DOI: 10.1161/01.cir.0000133601.16718.0f.
9. Wright AJ. John Webster Kirklin. *Encyclopedia of Alabama*. Retrieved 9 February 2019.
10. Gleysteen JJ. Kirklin, John W. *Physician Assistant History Society*. Retrieved 5 February 2019.
11. 3. Daly R, Dearani J, McGregor C et al. Fifty Years of Open-Heart Surgery at the Mayo Clinic. *Mayo Clin Proc*. 2005; 80(5): 636-640. DOI:10.4065/80.5.636.
12. Betsky A. *Architecture & Medicine: I. M. Pei Designs the Kirklin Clinic*. University Press of America. 1992. ISBN 9780819188786.
13. Pearce J. John W. Kirklin is dead at 86: innovator in cardiac surgery. *New York Times*. 2004.
14. Stephenson LW. *Historical perspective of The American Association for Thoracic Surgery: John W. Kirklin, MD (1917-2004)*. 2007; 134(1): 225-228.
15. Vaughan, Maryanne. UAB-News Archive- John Kirklin Cardiac Surgery Pioneer Dead at 86. UAB. 2004 (Apr 23.). Retrieved 9 February 2019.