Alberta Doctors' Digest

History: Dr. John Carter Callaghan

Fortuitously, I was recently introduced to Dr. John Carter Callaghan's family. It made me wonder if this pioneering cardiovascular surgeon had received the recognition he deserved, and as his mentor Dr. Wilfred Bigelow had already received.

As my research for my MSc in experimental surgery was primarily on his patients (1965/1966), I felt obligated to pursue the question further. The recent publication, *The Heartbeat of Innovation* (2022) on the cardiovascular history of the Toronto General Hospital (TGH), permitted a comparison of Dr. Callaghan's operative achievements with theirs.

Dr. Callaghan was a third-generation Canadian. His family came to Canada from Northern Ireland in 1863 on the ship Anglo-Saxon. The ship wrecked on Cape Race (the southern most part of Newfoundland), where 237 of its 446 passengers and crew perished. Only mother and father Callaghan and their six year old son James survived. Their other five children perished. From that tree came Dr. Callaghan. He was born in Hamilton, where his grandfather had merged five steel companies into Stelco and managed it until 1923.

As a youngster, 'Johnny' was unusually talented. He excelled at drama, acting, painting, drawing and school, completing Grade 12 at age 16. He already had an absorbing interest in anatomy, dissecting hearts and lungs and comparing their observations with current textbooks. It made his career decision to study medicine in 1939 easy.

Graduating in the war-accelerated program in February 1946, he interned at the TGH, before working for a year as an anatomy demonstrator, and evenings as a medical officer at the Lyndhurst Lodge for disabled veterans. Applying to enter the Gallie surgical course, his application was deferred because veterans had first choice. In lieu, he applied for a medical officer position in Aklavik, or "as far away from the Gallie course as I could get" to avoid any mistakes compromising his application.

In preparation, Dr. Callaghan spent three months in 1948 at the Toronto Weston, Toronto Western and Edmonton's Charles Camsell Hospitals studying illnesses in the north and particularly TB treatment, because the rate was eight times higher in the north. In Edmonton an opportunity arose to assist Dr. Walter Mackenzie perform a gall bladder operation. It started a life-long friendship.

With his wife Margaret and daughter Barbara, the Callaghans moved to Aklavik on July 8, 1948, joining 50 other non-Indigenous residents. From the start Dr. Callaghan was busy running clinics, making rounds at the Roman Catholic (25 beds) and Anglican (48 beds) hospitals, vaccinating, removing T&As and teeth, filling them, performing appendectomies and even a laparotomy for a perforated duodenal ulcer.

At the time, local emergencies were responded to by dogsled or boats on the Mackenzie River, with longer trips by airplane using skis or pontoons. On his first flight, he took the new portable X-ray unit with its 250-pound generator to nearby Tuktoyaktuk and found nine acute cases and nine mild cases of TB on 172 X-rays. Seeing the magnitude of the problem, he offered to perform the first TB survey of his 600 X 1000 km western region. The survey was arranged for the following April.

While evacuating a 40-year-old TB Indigenous person from Fort Good Hope on December 6, an oil leak forced pilot Mike Zubco to land the aircraft on a lake at -60 degrees Fahrenheit. Two walk-out attempts failed before the patient, Vital Barneby, succeeded in snowshoeing the 10 kilometers for help. A rescue team located the downed aircraft 72 hours after its landing and two hours after a fire had burned down part of their tent. A “thank goodness you’re safe” telegram would later arrive from Dr. Mackenzie.

The TB survey began on April 17, 1949 at Normal Wells, then continued on to Coppermine, where Dr. Callaghan was alerted to a flu epidemic at Cambridge Bay. He headed there and called the Camsell for help. On arrival, he found 15 had died and 45 were very sick. He created a hospital at the RCAF base and snowmobiled or flew the sickest patients to it. Dr. Callaghan left as the Camsell medical team arrived, after giving the sickest patients penicillin and sulpha to prevent pneumonia.

The survey continued, necessitating sleeping on house floors and in Hudson’s Bay Company offices, thawing out his equipment, landing in fog, running clinics, and giving vaccinations at the 18 centres he visited. In addition to the 206 X-rays taken during previous surveys, 791 more were screened for TB. As the trip ended, he developed the same flu symptoms and had to be medicated.

With his year ending in July, the Callaghan family returned to Toronto for the delivery of their first son, and confirmation of his acceptance into the Gallie course. The course required a year of research in the Banting laboratory under Dr. Bigelow. Reluctant at first, he was “on fire” within a month, studying the effects of hypothermia on laboratory dogs. To accelerate and more evenly cool and warm the laboratory dogs, they called in John Hopps, an engineer from the National Research Council. He recommended using diathermy coils. They worked, but the approach received limited acceptance.

When Dr. Callaghan noticed that mechanically stimulating a cooled heart during standstill caused a contraction, he asked Hopps to design an electronic generator that could deliver a controlled current that would stimulate the heart to beat at varying rates while taking over the normal S/A node rhythm. He found the electrode could be inserted into the heart via the jugular vein or located externally outside the heart and still work. Dr. Bigelow described this as the beginning of bioelectronics, and the signature discovery in cardiac pacing.

The cooling, pacemaking and rewarming results were presented to the American College of Surgeons in October 1950 and gained immediate attention. Dr. Mackenzie congratulated Dr. Callaghan afterwards. Published in the *Annals of Surgery* and in *The New York Times*, Dr. Callaghan would generously share the technical details with Dr. Paul Zoll in Boston. Dr. Zoll tried using the electrode on two patients (one lived) and published the results, giving himself credit for the concept and discovery.

Dr. John Carter Callaghan was the most noteworthy cardiovascular and thoracic surgeon in Canadian history. (Photo credit: U of A Hospital)

After completing his residency in general surgery, Dr. Callaghan secured a two-year McLaughlin post-doctoral scholarship to study at the TGH and in London and Los Angeles before moving to the University of Alberta to start their open-heart surgery program. After a year of building a bypass machine and practicing surgical techniques in the new Surgical Medical Research lab, he joined cardiologists Drs. Robert Fraser and Joe Dvorkin to carry out the first bypass operation on a pulmonary stenosis patient on September 18, 1956. It was a cautious start since the operation could have been done without bypass. Successful, they operated on a congenital atrial septal defect (ASD) in a 10-year-old on October 24. It was a Canadian first and gave her a normal life. The team completed a repair of a Tetralogy of Fallot in December and a more complex one in January 1957, both Canadian firsts.

Early operations took 10 hours, even though the maximum bypass time was never more than 63 minutes. During the first five years, all the patients had congenital heart disease. The team faced innumerable challenges choosing cases, practising, designing equipment, finding OR time and research space, building their teams, or performing unplanned re-operations. Blood was a critical factor. One case required 60 pints. With better pumps, less red cell damage occurred, and longer pump times became possible.

The U of A team presented their first 35 cases at the Royal College of Physicians and Surgeons of Canada (RCPSC) in October 1957. That month UBC surgeons performed their first ASD repair, three months before the TGH performed any open-heart procedures. Although Dr. Callaghan’s mortality rate in the beginning was low (25%), it appeared better than the later reported TGH rate of 33%.

Dr. Callaghan would attempt the first plastic Starr-Edwards ball valve insertion (1961). Although it failed, he performed a successful mitral valve replacement (1962), aortic

valve and aortic arch replacement (1962), double valve replacement (1963) and triple valve replacement (1963), all firsts in Canada.

After the Vineberg coronary artery bypass procedure was introduced (1963), Dr. Callaghan performed his first one ‘outside Montreal’ in 1964. Then in 1965 he successfully performed a ‘bloodless’ ASD repair on a six-year-old patient, using only saline as the perfusion solution, another first. Willing to analyze his failures, he published articles on the first 61 deaths (1961) and the first 50 Starr-Edwards insertions (1964), his mitral valve replacement complications (1974) and endocarditis complications (1982).

In the lab, Dr. Callaghan’s early research team focused on creating an artificial placenta to support respiratory function in lambs born prematurely. The project was successful in supporting one for 5-6 hours. The possibility however did reach the attention of *Life* magazine, which featured it in 1963. The project inspired investigators attempting to extend periods of extracorporeal oxygenation.

Always focused on decreasing deaths, he reported on 33 aortic replacements with only one loss. One case was shown live on CBC. His overall mortality rate was down to 4%. (1967), the year he produced the film *New Hearts for Old*. By then OR times were down to four hours and bypass times could be up to four hours. The team finished their 1,000th case on June 7, 1967, six years before Toronto reached that plateau.

Dr. Callaghan’s contribution to the medical literature reached 109 articles. Some were translated into multiple languages. He contributed chapters to two textbooks on cardiovascular surgery, including editing one. His bibliography would be twice that of Dr. Bigelow’s. He was invited to present the first Bigelow lecture in 1984.

A sought-after speaker (400 presentations), one focus was on preventing smoking as a way of decreasing lung cancer and heart disease. He noted that two packs per day increased the cancer rate 1,000 percent, and surgical cases were only 8 percent successful after five years. He would quit himself circa 1966.

In 1965 Dr. Callaghan secured a pledge from Alberta Health Minister Donovan Ross to fund a Western Canadian Heart Institute, as part of a subspecialty hospital expansion (1965). As construction costs soared, the Lougheed government cancelled the project (1971).

Dr. Callaghan’s refusal to advocate for heart transplants after the first Barnard operation in December 1967 garnered widespread attention. He felt the field of immunosuppression was too immature. His friend (renowned surgeon) Denton Cooley agreed, but told Dr. Callaghan, “I’ll nevertheless be dong transplants and have a heart institute before you.” Sadly, that is what happened.

Dr. Callaghan retired from cardiovascular open-heart operations in 1986. With his extra time, he contacted the original open-heart team for their recollections and published them in the personable *30 years of Open-Heart Surgery at the University of Alberta Hospitals* (1986). He also introduced a future book on his year in the Northwest Territories in 1995, which his son completed in 2008.

In retirement, he worked as a medical director for the Western Regional Authority and a consultant to Workers’ Compensation Board and the College of Physicians and Surgeons. Reflecting on his career, Dr Callaghan said, “If I hadn’t been able to withstand the stress of my practice, I’d have left it. I doubt I’d have lasted if technology hadn’t

improved over the years. My primary goal was always the survival and improvement of the patient.”

Dr. Callaghan passed away on April 6, 2004, the most noteworthy cardiovascular and thoracic surgeon in Canadian history.

Banner image credit: U of A Hospital