

The Quebec Heart Institute: 50 years of excellence in cardiology

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The Quebec Heart Institute was established in 1957 at the Laval Hospital in Sainte-Foy, Quebec. Since then, clinical and research activities have made this Institute one of the largest tertiary care cardiology centres in Canada. With its vast catchment area of more than 3,000,000 people, the Institute has developed a strong collaboration with referral physicians centred on clinical, teaching and research interests. The Institute pioneered several aspects of cardiac surgery, invasive cardiology, echocardiography, basic research and, more recently, a network of researchers and clinicians working in the field of 'metabolic cardiology'. The first 50 years of the Quebec Heart Institute are depicted in this overview, which will also introduce this special supplement to *The Canadian Journal of Cardiology*.

Key Words: *Cardiology; Heart Institute*

ORIGIN OF THE QUEBEC HEART INSTITUTE AT LAVAL HOSPITAL

Laval Hospital, founded in 1918 and administered by the Sisters of Charity of Quebec, was originally essentially dedicated to the treatment of tuberculosis. In the mid-1950s, visionary phthysiologists anticipated the decline in pulmonary tuberculosis and the rise in cardiac diseases. They promoted the development of a cardiology department at Laval Hospital. Engaging the Sisters' collaboration, they facilitated the recruitment of cardiologists and cardiac surgeons. In 1957, a charter was approved recognizing the Quebec Heart Institute, an entity within Laval Hospital, endowed with the mission of dispensing tertiary care to patients with cardiac disease; teaching medical students, interns and residents; and developing a cardiovascular research program.

A unique feature of the early recruitment was the association of pediatric cardiologists with the multidisciplinary group of cardiologists and cardiac surgeons. The cardiac surgical procedures that were initially predominant were performed in patients with congenital heart disease (1,2), and these set the basis for the cardiac surgery that continues to be performed at the Institute today. Although congenital, rheumatic and, to a lesser degree, ischemic heart disease constituted the principal cardiac pathologies treated at the Institute in the mid-1960s (2-4), an unusual presentation of endemic, acute, life-threatening heart failure was documented in Quebec City, subsequently designated as the Quebec beer-drinkers' cardiomyopathy (5). The clinical

L'Institut de cardiologie de Québec : 50 ans d'excellence en cardiologie

L'Institut de cardiologie de Québec a été fondé en 1957 à l'Hôpital Laval de Sainte-Foy, au Québec. Depuis, les activités cliniques et de recherche ont fait de cet institut l'un des plus grands centres tertiaires de cardiologie au Canada. Avec une vaste zone hospitalière de plus de 3 000 000 de personnes, l'Institut a développé une solide collaboration avec les médecins traitants à l'égard d'intérêts cliniques, d'enseignement et de recherche. L'Institut a été le pionnier de plusieurs aspects de la chirurgie cardiaque, de la cardiologie effractive, de l'échocardiographie, de la recherche fondamentale et, plus récemment, d'un réseau de chercheurs et de cliniciens dans le domaine de la « cardiologie métabolique ». Les 50 premières années de l'Institut de cardiologie de Québec sont relatées dans cet aperçu, qui présente également le présent supplément spécial du *Journal canadien de cardiologie*.

characterization of this peculiar entity stimulated the development of a research laboratory to define the ultrastructural pathology and to study the metabolic factors potentially associated with this type of cardiomyopathy.

In 1971, as elsewhere in the province of Quebec, the government established direct control of hospital administration, and consistent with newly established legislation, health care at Laval Hospital became centralized. Thus, the charter of the Quebec Heart Institute was amended in 1975 with respect to clinical health services, but the Institute decided to maintain a distinct charter for its two other missions – teaching and research (6).

THE 1970s: A PERIOD OF RAPID DEVELOPMENT

The 1970s were characterized by important recruitments and the creation of new services. Echocardiography and electrophysiology laboratories were established and rapidly expanded. Coronary artery bypass graft surgery began in 1970 and steadily increased thereafter. In 1971, a cardiac rehabilitation centre was inaugurated within the hospital's main chapel (with the blessing of the sisters) and relocated in 1979 to a new hospital pavilion dedicated to cardiovascular disease prevention and rehabilitation.

Consistent with its mission, the Institute contributed to the training of cardiology fellows and residents, as well as to the teaching of cardiovascular disease to medical students.

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Members of the Institute were appointed by Laval University to create a formal cardiology program, and others were very active in continuing medical education. Innovative approaches in teaching methods were initiated as early as 1973 with the use of computerized programs. These approaches generated results comparable with those of traditional approaches but were better adapted to the schedules of general practitioners (7).

The research group included basic researchers and clinical investigators. The main research themes at that time were cardiac metabolism from bench to bedside (8-10), the echocardiographic study of cardiac and valve function (11), and the Quebec Cardiovascular Study, an ambitious epidemiological project on cardiovascular risk factors that involved 4800 men aged 35 to 64 years from Quebec who were selected at random and followed from 1974 to 1998 (12).

THE 1980s AND 1990s: A PERIOD OF FURTHER DEVELOPMENT AND CONSOLIDATION

The 1980s and 1990s were marked by the recruitment of young cardiologists and cardiac surgeons. New facilities in cardiac surgery, acute coronary care, echocardiography, cardiac catheterization and electrophysiology were established in response to the increasing demand for tertiary cardiac care of an ever-aging population living between Trois-Rivières and Gaspé, as well as in the northern part of New Brunswick. Indeed, by the end of the 1990s, the Quebec Heart Institute had become one of the Canadian institutions with the highest number of patients undergoing cardiac surgery. Unfortunately, in the mid-1980s, the three pediatric cardiologists left the Institute for the department of pediatrics at the Laval University Hospital. Nevertheless, all congenital heart surgeries continued to be performed at the Institute.

Despite the increased clinical workload, this was the period of innovation and landmark studies on cardiac valve surgery and echocardiographic assessments (13-17), highlighting the value and limitations of valve replacements, tissue valves, mechanical valves and prosthetic valve mismatches (18-21). During this period, the Ross procedure was adopted at the Institute, and subsequently the Institute became a pioneer of this surgical procedure in Canada (22,23). To date, 221 Ross procedures have been performed at the Institute (118 of these were performed by Dr P Cartier, who pioneered the surgery). This was also the period of establishing the expertise of the radial artery access for cardiac catheterization (24), an approach now well recognized in the cardiovascular community and mainly developed at the Quebec Heart Institute. In addition, cardiac surgery expanded and a cardiac transplantation program was established. The electrophysiology service was consolidated and the catheter ablation program was expanded.

In addition to successful research on valve disease, there were four other research themes: basic pharmacology, coronary circulation physiology, clinical mechanistic and prognostic studies in ischemic heart disease, and epidemiological studies on risk factors for cardiovascular disease. The team performing bench research in pharmacology was productive in assessing the impact of diuretics, antibiotics and gastrointestinal medications on potassium channels (25-27), and the development of assay approaches to explore the effects of antiarrhythmic medications on sodium channels (28,29). Fundamental researchers and electrophysiologists collaborated on fruitful studies (30,31). The team dedicated to coronary circulation physiology evaluated the distribution of subendocardial coronary

flow under various hemodynamic conditions and pharmacological interventions (32,33). In clinical research, cardiologists determined the diagnostic and prognostic value and limitations of the electrocardiogram during exercise stress testing (34-36). Finally, the team working on the Quebec Cardiovascular Study demonstrated that metabolic markers, such as insulin, small dense low-density lipoprotein cholesterol and apolipoprotein B, were significant predictors of cardiovascular events (37-39), and the simultaneous presence of these abnormalities was defined as the 'atherogenic metabolic triad'.

THE 2000s: A PERIOD OF EXPANSION

During the 2000s, there was a major expansion in the main research sectors at Laval Hospital. In addition to the two main multidisciplinary departments, cardiology and pneumology, a third sector was created in anticipation of a growing problem: obesity. The large, internationally known Laval University research program in obesity was integrated at the Laval Hospital Research Centre. These three sectors now constitute the main research themes at Laval Hospital and are major assets for expanding interrelated research programs and promoting cross-fertilization. Indeed, clinical investigators and basic scientists – with new expertise in cardiovascular disease, diabetes and obesity – are collaborating on several projects (40,41). Examples of such joint efforts are projects on inflammatory markers, lipid fractions, nutrition, exercise and other risk factors. For instance, it was found that the simultaneous presence of increased waist circumference and elevated fasting triglyceride concentration could identify a high proportion of individuals at risk for ischemic heart disease due to the presence of the features of the metabolic syndrome (42-44). The network of basic scientists and clinical investigators in the field of 'metabolic cardiology' has expanded to include investigators working on heart valve disease, and this cofertilization has been particularly fruitful (45,46).

Other recently recruited expertise has had a major impact in the field of magnetic resonance imaging, new invasive percutaneous techniques for the treatment of congenital heart disease, ischemic heart disease and aortic dissection, as well as minimally invasive cardiac surgery. The first minimally invasive mitral valve repair (Heartport technique) was performed at the Quebec Heart Institute in 2004. In 2005, a team of cardiologists and surgeons performed the first percutaneous pulmonic valve implantation in the province of Quebec.

The period from 2000 to 2007 was also notable in other research fields. The successful heart valve program expanded into the basic laboratory, where novel animal models were developed (47-51); further studies were undertaken on mismatched prosthesis and tissue valve structural changes (52-56). In electrophysiology, the recruitment favoured further development in pharmacological research, clinical investigation and epidemiological studies. The electrophysiology division pioneered several aspects of radiofrequency catheter ablation (57) and cardiac resynchronization (58), and the basic electrophysiology research program also consolidated its activities. The research program on mechanistic studies expanded, focusing mainly on warm-up ischemia and inflammatory markers (59-62), and further assessed cardiovascular exercise response (63), thrombogenesis in foramen ovale closure (64) and the usefulness of coronary fractional flow reserve to guide coronary revascularization (65). The past 10 years were also a period of intense participation in large clinical trials with McMaster

University (Hamilton, Ontario) (66) and other groups (67). It was also the period when young investigators set up a large clinical program in invasive cardiology. In a randomized trial (68), they showed the feasibility and safety of same-day discharge after percutaneous coronary intervention. The investigators are presently leading a multicentre trial on intervention aimed at the regression/stabilization of atherosclerotic plaques.

CONTINUING TO FULFILL THE ORIGINAL MISSION

The Quebec Heart Institute at Laval Hospital is the only tertiary cardiology hospital for the entire centre and eastern regions of the province of Quebec with a referral population of approximately 3,000,000 people. Today, 30 cardiologists and nine cardiac surgeons assume tertiary cardiac care for this population; with more than 2000 cardiac surgeries, 9000 cardiac catheterizations and 2000 electrophysiology procedures performed annually, this clinical service is among the largest in Canada. During the past 50 years, the members of the Institute have developed new diagnostic and therapeutic approaches, specialized clinics, and cardiac prevention and rehabilitation programs.

During these 50 years, teaching has been a major mission at the Institute. The medical staff has contributed to the training of cardiology residents and fellows. At the time of writing, 12 cardiology residents and nine fellows are in training at the Institute. The cardiology program has always been highly valued by the Royal College of Physicians and Surgeons

of Canada and the Collège des médecins du Québec. Similarly, the contribution of the medical staff to the teaching of medical students and to continuous medical education has been considered outstanding.

The research activities of the past five decades have been remarkable. Today, the cardiac research centre has 51 scientists (medical doctors and Doctors of Philosophy) and 41 graduate students and postdoctoral fellows. In 2005, the group achieved the milestone of 100 articles published in peer-reviewed journals. The integration of obesity research with cardiovascular disease constitutes a unique achievement. Another strength is the amalgamation of clinical investigators and basic scientists working in different fields, from genetic and metabolic studies to ongoing clinical interventions in ischemic heart disease, heart valve disease and diabetes. Finally, ongoing studies using new imaging technologies focusing on vascular disease are assessing novel approaches to reduce acute ischemic heart disease events. The research is considered to have reached a level that is an add-on to the clinical service.

These achievements are the fruits of a remarkable team effort committed to teaching, research, and the continuous improvement of clinical care and the prevention of cardiovascular disease. However, such accomplishments were also made possible because throughout these 50 years, people believed in and strove to consolidate the mission of the Institute, notably the founding Sisters of Charity, the Laval Hospital administration, Laval University, and the Foundation of the Quebec Heart Institute and its dedicated members.

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