Fifty years of medicine: The surgical heritage of a pioneer – Paul Cartier MD (1919–2008)

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For more than 45 years, Dr Paul Cartier was active in the field of cardiovascular surgery at the Hôtel-Dieu Hospital of Montreal, Quebec. During these years, he witnessed and took part in many premieres in cardiovascular surgery, which made him a privileged actor in this field. The following is a brief review of his long career.

When Dr Paul Cartier finished medical school in 1947, medicine had a long way to go. Abdominal aortic aneurysms were treated by proximal and distal ligation, and Dr Clarence Crafoord had just performed the first surgical correction of a congenital aortic coarctation. As well, Dr Charles P Bailey had not yet rehabilitated 'closed' mitral commissurotomy, synthetic vascular grafts were science fiction, peripheral vascular surgery was more synonymous with amputation, and thoracic surgery was just emerging. After obtaining his medical degree at the University of Montreal (Montreal), Dr Cartier initiated his surgical residency at the same university with specific orientation in thoracic surgery. In 1951/1952, he left for St Louis, Missouri (USA), where he was appointed as a resident in thoracic surgery under Dr Evarts A Graham (who performed the first pneumonectomy for lung cancer) and Dr T Burford. Then, he moved to Case Western Reserve University in Cleveland, Ohio (USA), under the supervision of Dr Claude S Beck. Although Beck was trained as a neurosurgeon, he had a great deal of interest in congenital and acquired heart disease. During those days, he was busy mastering his astonishing 'Beck II' operation, which consisted of direct anastomosis between the coronary sinus and the descending aorta for the purpose of increasing retrograde coronary blood flow to the ischemic heart. In 1952/1953, Dr Cartier moved again, but this time to France – to Broussais Hospital (Paris) – to work with Dr Charles Dubost who, in 1953, performed the first aorto-iliac homograft bypass for an infrarenal aortic aneurysm. Under Dubost's supervision, he learned the clinical potential and limitations of closed heart mitral commissurotomy (through a left thoracotomy on a beating heart). During the same journey, he also spent time with Dr Marceau Servel, then staff surgeon at St Joseph Hospital (France), whose major interests were in vascular, lymphatic and cardiac surgery. On his way home, he stopped in London, Great Britain, to observe Dr Russell Brock, a pioneer in pediatric cardiac surgery, performing (with the instrument named after him) congenital pulmonary stenosis corrections on the beating heart. Finally, in 1953, Dr Cartier was appointed the position of thoracic surgeon at Hôtel-Dieu Hospital of Montreal. His long-lived career was then launched on three different fronts: pediatric cardiac surgery, adult thoracic and cardiac surgery, and peripheral vascular surgery. We will review these three aspects of his outstanding career and point out the distinguishing features that made Dr Paul Cartier a pioneer in the field of cardiovascular surgery.

Pediatric cardiac surgery (1953 to 1960)

In 1953, Dr Cartier opened the Department of Pediatric Cardiac Surgery at Sainte-Justine Hospital and achieved many firsts in Montreal. He accomplished the first successful palliative shunt (Blalock Taussig) in an infant affected by tetralogy of Fallot, the first repair of congenital coarctation of the thoracic aorta in a three-year-old infant, the first case of division and section of a patent ductus arteriosus, and the first attempt at neonatal correction of arterial transposition by surgically fashioned atrial septal defect.

Adult thoracic and cardiac surgery (1953 to 1972)

In August 1953, he introduced closed heart mitral commissurotomy at Hôtel-Dieu Hospital of Montreal. He performed more than 600 procedures between 1953 and 1972. In August 1954, he resected a giant left atrial myxoma under deep hypothermia and 'inflow occlusion'. In 1955, he introduced the surgical treatment of coronary insufficiency through procedures available at that time: the Weinberg operation (implantation of an internal thoracic artery pedicle in the ischemic myocardium) and Beck I (pericardial poudrage). In 1958, he attempted an endarterectomy of the left anterior descending artery – a precursor procedure of modern-era direct coronary artery revascularization.

Vascular surgery (1955 to 1997)

However, it is in the field of vascular surgery that Dr Cartier is really known. Challenged by the difficult management of patients affected by severe peripheral vascular disease, he was soon involved in their surgical treatment. In 1949, Dr Jean Kunlin (1) reported the first successful series of reverse saphenous vein grafting for the correction of peripheral occlusive disease. Concerned by the invasiveness of the technique, Dr Cartier imagined a different way of doing it – by simplifying the extent of saphenous vein dissection. In 1959, suturing the posterior saphenous vein proximally to the popliteal artery, he explored the potential advantage of retrograde revascularization through the venous system in a severely ischemic limb (Figure 1). Although the patient did not improve substantially, the posterior saphenous vein remained patent for more than 10 days. The latter observation inspired Dr Cartier, and a few months later (February 1960), he accomplished his first successful nonreversed in situ femoropopliteal bypass on a gangrenous ischemic leg. The

Figure 1) First in situ bypass in 1959

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Figure 2) Dr Cartier's original description and schematics of in situ bypass

procedure and original schematics are displayed in Figure 2. A year earlier (June 1959), he performed the first femorofemoral bypass procedure using a nylon graft, to relieve ischemic pain secondary to left common iliac occlusion. In 1961, he undertook the first axillofemoral bypass combined with femorofemoral bypass in a poor-risk patient afflicted by severe limb ischemia. All of these procedures were world premieres. Soon, he designed and developed his own valvulotome, which consisted of a wire attached to an enlarged tip shaped like the Gemini spacecraft that allowed destruction of the internal saphenous vein valve (Figure 3). His valvulotome procured forward flow in the graft, making vein reversal obsolete. In the following years, he mastered this technique and extended its use to distal tibial vessels in more than 800 procedures. Encouraged by the success of the technique, he enlarged its indications to other vascular sites and, in 1961, he performed the first in situ cephalic vein bypass in a patient who presented with a subclavian artery aneurysm. Later on, he extended indications of the procedure to treat 'crutches arteritis syndrome', which is obstructive degeneration of the axillary artery due to chronic compressive trauma caused by crutches. Concurrently, during the same period, Dr Cartier broadened his surgical interest to the thoracic and abdominal aorta. In 1955, he introduced, in his institution, freshly preserved cadaveric homografts for elective surgical correction of infrarenal aortic aneurysm and Leriche syndrome. In 1957, he successfully repaired a ruptured infrarenal aortic aneurysm – the first repair ever done in Canada. In 1960, he achieved his first thoracic aneurysm resection using a shunt made of Dacron that was temporarily grafted from the ascending to the distal aorta, to secure the procedure and prevent paraplegia. At 78 years of age, still active in surgery and always interested in new technologies, he participated in the implantation of the second endovascular stent graft in Canada for the treatment of a post-traumatic false thoracic aneurysm, 'completing the circle' of his experience.

Pursuing his constant quest for a better understanding of vascular diseases, Dr Cartier pioneered carotid surgery. In 1955, he performed his

Figure 3) Valvulotome created by Dr Paul Cartier to destroy the venous valve during in situ bypass

first carotid endarterectomy for acute stroke. Unfortunately, the patient did not survive because cerebral damage present before the operation was beyond any possible repair and recovery. In the following years, Dr Cartier started to perform carotid endarterectomy in symptomatic and asymptomatic patients on a regular basis, performing more than 800 of these procedures. He was among the first surgeons worldwide to pioneer the use of carotid Doppler ultrasonography as a unique means of preoperative assessment (2). Interestingly, in the early 1960s, Dr Cartier was already a strong proponent of mannitol for the prevention of renal shutdown during abdominal aortic surgery and an ardent advocate of daily acetylsalicylic acid intake in thrombotic event prevention among patients affected by peripheral vascular disease. Also in the early 1960s, in desperate cases of peripheral nonreconstructable vascular disease, he pioneered intra-arterial histamine infusion to increase collateral flow. Innocently, 20 years before Furchgott's discovery, Dr Cartier experimented with the beneficial effects of vascular endothelial nitric oxide release through histaminic receptor activation.

In December 1997, he retired after 51 years of an active medical career, including 45 years of surgery. In 2000, at 81 years of age, Dr Cartier was given the title "Officier de l'ordre National du Québec" in recognition of his surgical achievements, crowning a successful professional life.

During all these years, Dr Cartier was assisted by his wife, Dr Thérèse Deschênes-Cartier, an anesthesiologist who always supported him unconditionally. Among their four sons, three embraced cardiovascular surgical careers and one opted for engineering. Unfortunately, their oldest son, Paul Jr, passed away prematurely in 2001, at 48 years of age, in the middle of a very active career in pediatric cardiac surgery, leaving the entire family in grief.

On May 26, 2008, Dr Paul Cartier quietly passed away at the dawn of his 89th birthday, surrounded by his family, and leaving behind him a very fruitful and accomplished life. He will be remembered as the father of vascular surgery in the province of Quebec and in Canada.

REFERENCES

1. Kunlin J. Le traitement de l'artérite oblitérante par la greffe veineuse. Arch Mal Coeur Vaiss 1949;42:371-5.
2. Cartier R, Cartier P, Fontaine A. Carotid endarterectomy without angiography. The reliability of Doppler ultrasonography and duplex scanning in preoperative assessment. Can J Surg 1993;36:411-6.