Japan Academy Prize to:

Soichiro Kitamura
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for “A New Arena in Cardiac Surgery: Pediatric Coronary Artery Bypass Surgery”

Outline of the work:

Background for the Development of a New Operation

Before the 1970s, pediatric coronary artery bypass surgery (PCABS) was not performed due to the lack of compelling surgical indications. The advent of coronary artery sequelae secondary to Kawasaki disease (KD) and the occurrence of coronary artery complications of newly developed procedures for complicated congenital heart diseases, such as the arterial switch operation for complete transposition of the great arteries or Taussig–Bing anomaly, the Ross procedure requiring coronary artery transfer, and the correction of intrinsic coronary malformations necessitated the development of PCABS. Particularly in Japan, mortality in children affected by KD was frequently recognized as a social crisis in the 1970s and 1980s. However, there had been no reports of attempted PCABS, and the prevailing opinion in Japan was that surgery had little to offer for this acute inflammatory condition. Dr. Soichiro Kitamura developed a novel method for PCABS by utilizing the uni- or bilateral internal thoracic arteries (ITAs) in children using a surgical microscope or powerful magnifying glasses to achieve a secure anastomosis for small vessels <1 mm in diameter, and reported the world’s first successful case in 1983.

Identifying the Surgical Indications

Dr. Kitamura initiated selective coronary arteriography in small children by using a 4F or 5F handmade catheter shaped like the Judkins coronary catheters. These had size and curve adjustments fashioned by superimposing the catheters on the lateral chest X-ray films of the subject. Although a variety of coronary lesions were identified among individuals with KD, obstructive lesions most commonly involved the entry or exit portions of coronary aneurysms, which were frequently located in the proximal portions of coronary arteries, i.e., the left main trunk, particularly in the left coronary system. In contrast, right coronary artery lesions tended to involve more distal areas before and sometimes beyond the bifurcation. These findings undermined the initial belief that surgical indications would be quite rare in KD. Surgical coronary revascularization was soon accepted to play a role in KD management and was included in the treatment guidelines for KD in Japan.
Surgery and Graft Selection

For the first time, using the mathematical analysis of bidirectional-imaged grafts, Dr. Kitamura demonstrated that the ITA graft has the potential to grow longitudinally and circumferentially along with the child’s somatic growth. The fact that the bilateral use of the ITA does not result in any adverse effects on the thoracic development of children was also demonstrated. Also, long-term patency without graft degeneration of the ITA has been clearly demonstrated by a 30-year follow-up study with more than 100 children. Overall, 95% of the children operated on with this surgery are alive at 30 years postoperatively, more than 84% can work well and integrate into society without any limitations, and females can safely carry and deliver a baby. The multicenter cooperative study conducted by Dr. Kitamura has shown that the presence of ITA grafts to the heart is significantly beneficial in the long-term survival of children with KD. The fact that the ITA is very rarely affected by KD is a key point of consideration for this surgical treatment.

In contrast, the autologous saphenous vein graft, which was used in the initial stages of development of PCABS (1975 by Dr. Kitamura), has proved inadequate as a graft in children because of the lack of longitudinal growth potential, significantly worse patency than the ITA, particularly in small children younger than 10 years, and early vein graft degeneration eventually leading to immature atherosclerosis in 10–20 years after surgery in childhood.

Current Status of Pediatric Coronary Revascularization Surgery

PCABS using uni- or bilateral ITA has now been accepted worldwide as the ideal choice for children with coronary artery obstructive lesions either due to KD or congenital coronary disorders, creating a new surgical arena. This surgery has a very low surgical mortality and demonstrates long-term benefits for growing children. Many English and Spanish language textbooks have been published in the world; in several surgical reports regarding coronary complications, this operation is referred to as “The Kitamura Operation” and has created a new subspecialty. The operation can now be successfully applied to neonates, regardless of their age, and is beneficial in children affected by coronary problems worldwide.

List of Main Publications

Papers


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