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Artículo especial

Cirugia de la patología de la aorta torácica: Estrategias en evolución hacia los enemigos crecientes

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Surgery for thoracic aortic disease: evolving strategies towards the growing enemies

INTRODUCTION

With advancement of the elder-society, the number of patients who have aortic disease has been increasing steadily. Awareness regarding aortic disease has played a major role in its detection and also the innovational refinement in diagnostic tools for aortic disease has been prerequisite for recruiting the patients. On the other hand, results of surgery has been improving because of advancement of surgical technologies, knowledge of the disease, utilization of sealed grafts, improved protection of the central nervous system, development of stent-grafting, and continuing efforts of the surgeons.

According to the survey by the Japanese Association for Thoracic Surgery since 1984, the annual number of operations for the thoracic aorta has dramatically increased from 712 in 1984 to 9876 in 2006 (Figs. 1 y 2). The number of the stent-grafting interventions for the thoracic aorta was 617 in 2006 in Japan (Fig. 3). The results of surgery, of course, have improved throughout. Hospital mortality after elective arch replacement achieved to be 6.7% and hospital mortality after emergent operation for acute type A aortic dissection was reported to be 13.4% in Japanese 2006 registry (Figs. 4-7). However, the strategies for treating the aortic disease have been emerged as having widespread options, including endovascular stent-grafting or hybrid-stent grafting. Surgeons should be ready for any armamentarium of these strategies and should be fluent for clinical applications. The Spanish Society of Thoracic and Cardiovascular Surgery organized an Ad-Hoc team, the Working Group on Diseases of the Aorta and is now going to publish a monograph regarding the surgical treatment of aortic disease. This working group coordinated by Calbet and Mestres, editor-in-chief, has prepared a thorough review. The Spanish Society and they should be congratulated for a timely issue.

AORTIC ROOT AND ASCENDING AORTA

The gold standard for replacing the aortic root has still been the Bentall-DeBono operation since 1968[1], however, complications with anticoagulation and structural or non-structural prosthesis deterioration have shifted the paradigm towards the valve sparing aortic root operation, such as Yacoub's remodeling[2] and David's reimplantation[3] procedures. A significant number of patients has normal aortic cusp with dilatation of left ventricular outflow tract (basal ring), sinus of Valsalva and sino-tubular junction (ST junction). These patients can have the most benefit of the valve sparing operation.

Recent debate over the superiority of the two procedures has almost reached conclusions. The future dilatation of the basal ring and interleaflet triangle after remodeling operation has precluded application of the remodeling procedure to the young Marfan patients with

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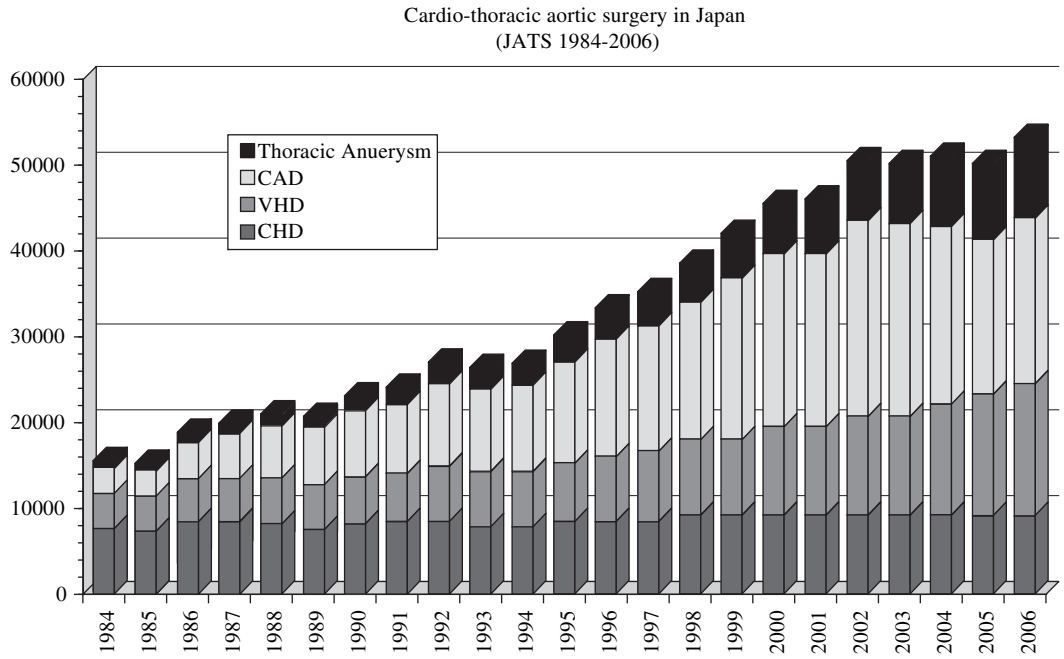

Figure 1. *The number of cardio-thoracic aortic surgery in Japan from 1984-2006. CAD: coronary artery disease; VHD: valvular heart disease, CHD: congenital heart disease.*

dilated basal ring. Patients with less enlargement of the basal ring with dilatation of the sinus and ST junction tolerate the remodeling procedure. The intrinsic disadvantage of the reimplantation procedure is theoretically considered to be that the straight dacron tube has no physiological effects of sinus Valsalva. Although numerous modifications of the reimplantation to mimic the Valsalva sinus has been tried, such as those of Cochran, De Paulis graft, David V operation, Stanford and Gleason[4-8], none has could demonstrated the advantages of hemodynamic and long-term durability over the straight graft clinically. Another challenge in this field has been tried

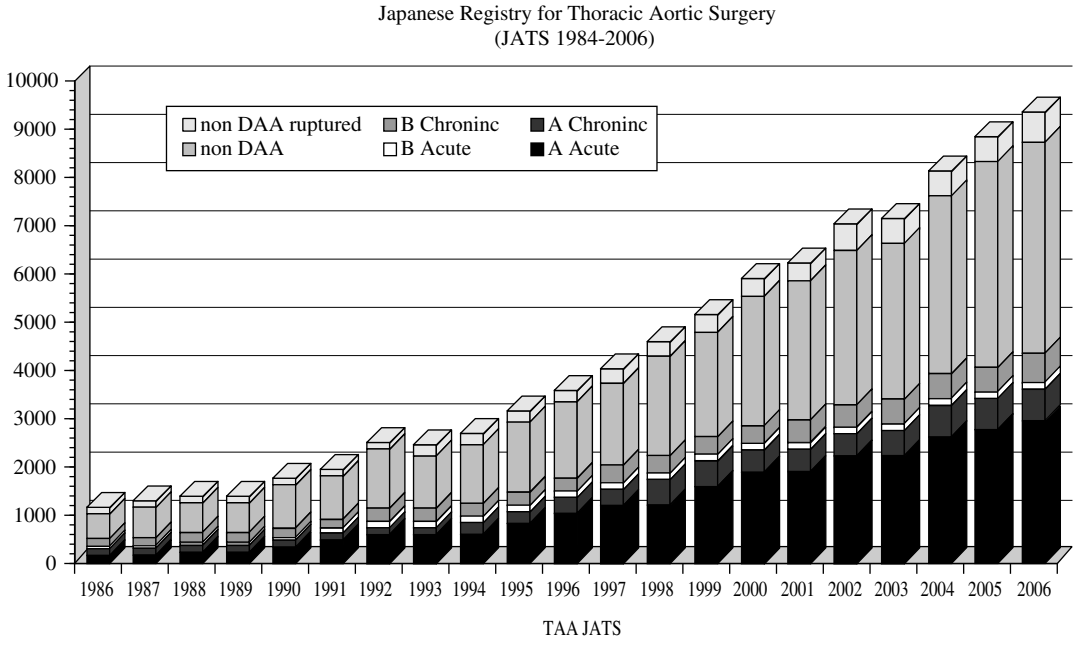

Figure 2. *The number of thoracic aortic surgery according to acuity in Japan from 1984-2006.*

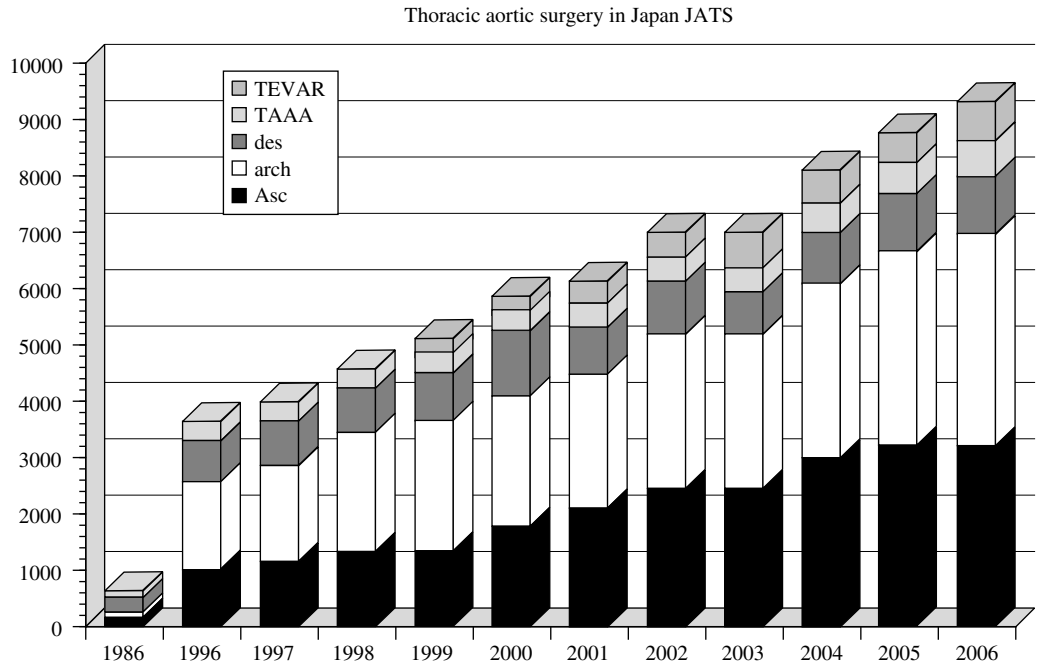

Figure 3. *The number of thoracic aortic surgery according to the site of the aneurysm in Japan from 1984-2006. Asc: ascending aorta; arch: aortic arch; des: descending aorta; TAAA: thoracoabdominal aorta; TEVAR: endovascular stent-grafting.*

in repairing the abnormal aortic cusps. Cusp prolapse is often seen in this patient population. Several techniques, such as plication or reinforcement of the stretched free margin, and patching the defect have been applied. But also the valve sparing root procedures has been applied in patients with acute aortic dissection. The long-term results in these patients have not been yet proven.

Another topic in replacing the ascending aorta is to lower the threshold regarding the diameter of the ascending aorta for surgery. Accumulation of the long-term fate of the dilated ascending aorta has warned the risk of aortic rupture and dissection. Patients with Marfan syndrome or bicuspid aorta have sometimes died prematurely because of these complications. General

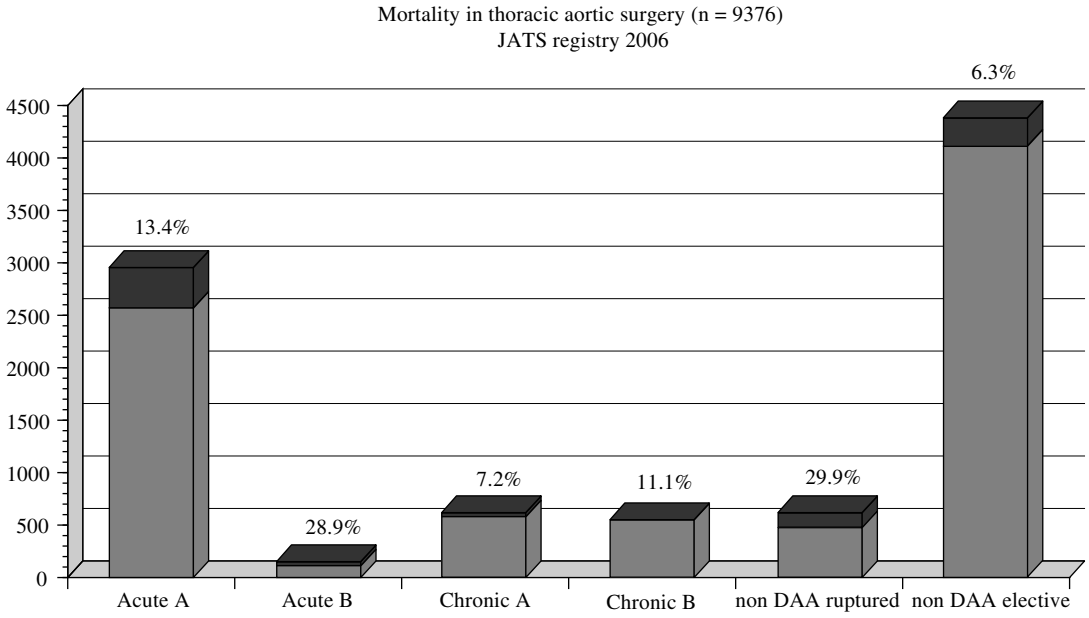

Figure 4. *Early mortality according to the acuity in thoracic aortic surgery in 2006 in Japan.*

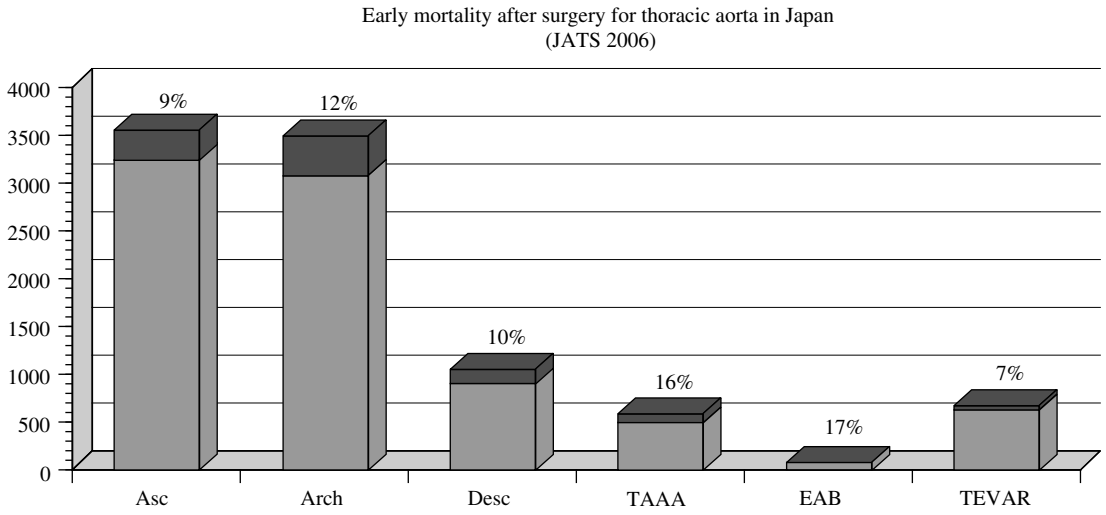

Figure 5. *Early mortality according to the sites of the aneurysm in thoracic aortic surgery in 2006 in Japan.*

consensus seems to be made to intervene earlier, replacing the dilated aorta at the diameter over 4.0-4.5 cm in the group of high risk patients[9].

BRAIN PROTECTION

The most important aspects in aortic arch surgery are considered to be safe brain protection and secure anastomosis. One of the major causes of postoperative stroke is the brain embolism from the different sites of atherosclerosis and thrombi, such as mural plaque, aortic clamping, vascular anastomosis, and aortic or cerebral perfusion cannulae. No thoracic aortic lesions have been free from the brain embolism perioperatively. However, meticulous searching the atheroma of the aorta, by preoperative computed tomography (CT), echogram, and intraoperative direct echogram can provide important

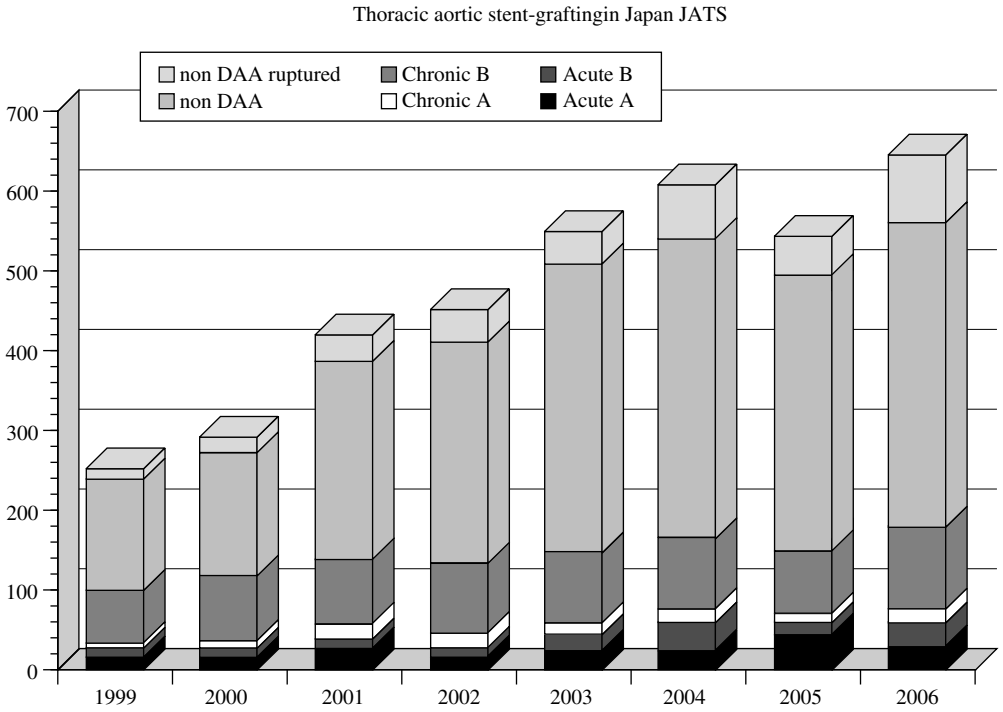

Figure 6. *The number of thoracic aortic stent-grafting according to acuity in Japan from 1999-2006.*

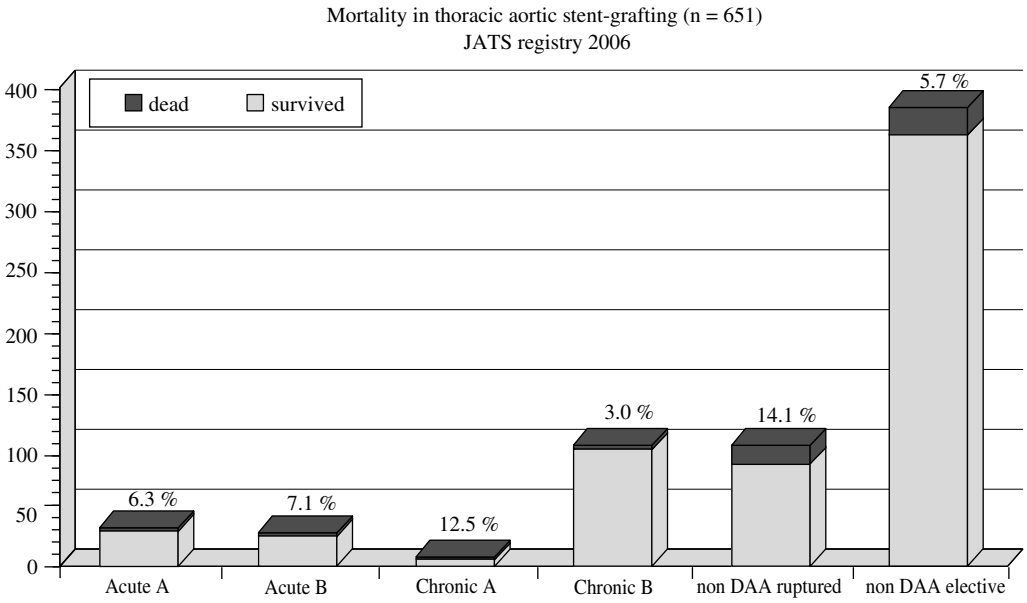

Figure 7. *Early mortality according to the acuity in thoracic aortic stent-grafting in 2006 in Japan.*

information for selecting the site of cannulation and clamping. Manipulation of the atheromatous aorta should be avoided as much as possible to prevent atheroembolism. Although the antegrade perfusion from the ascending aorta is preferred, sometimes the atheromatous aorta precludes cannulation in the ascending aorta and peripheral arterial cannulation from the axillary artery or femoral artery is selected[10]. However, the axillary arterial cannulation sometimes causes atheroemboli from the atheromatous lesion at the orifice of the brachiocephalic artery[11,12].

Brain protection against the prolonged ischemia has been studied since the advent of the aortic arch surgery. Antegrade pulsatile cerebral perfusion under normothermia theoretically provides best brain protection, however, the known uncertainty and unknown certainty of the brain circulation led the strategy of the brain protection to the world of hypothermia and circulatory arrest because the deep hypothermia was the most reliable method to protect the brain[13-15]. Recent advancement regarding the brain circulation has promoted us to apply more physiological strategies towards the brain protection. Selective antegrade cerebral perfusion from the brachiocephalic and left common carotid artery, sometimes including the left subclavian artery under deep, moderate, or even mild hypothermia has achieved a safe protection of the brain for a prolonged cardiopulmonary bypass, even in the cost of more chance to distal embolization[16]. On the other hand, trying to minimize the duration of the circulatory arrest of the brain with simple deep hypothermia or with retrograde cerebral perfusion, the arch first technique, has similar successful results to the antegrade cerebral perfusion[17]. We do not want to argue which is the better way to protect the brain here and do want to achieve the best result for the patients. The results of arch replacement in the leading institution were reported as the mortality in the elective surgery ranged from 3 to 7 percent and the incidence of stroke 5%.

THORACOABDOMINAL AORTIC ANEURYSM

Surgery for thoracoabdominal aorta actually began before the era of cardiopulmonary bypass. In 1965, DeBakey reported their results as 26% mortality in 42 patients with thoracoabdominal aortic aneurysms who underwent the extra-anatomical reconstruction of the thoracoabdominal aorta without using a cardiopulmonary bypass[18]. Crawford, et al. modified and simplified the operation[19], such as "in-situ" reconstruction of the thoracoabdominal aorta using the inclusion technique, reducing hospital mortality to 8% by 1978. After using a simple proximal aortic clamping, they classified the thoracoabdominal aortic aneurysm into four categories according to its extension and demonstrated that early mortality and postoperative neurological deficit were 10.7% overall and 28.3% in extent II aneurysm[20]. The progress of thoracoabdominal aortic surgery has mainly been achieved by the "sons" of Crawford. Coselli, et al. reported an enormous surgical series of thoracoabdomi-

nal aorta with an exceptionally good result[21]. Safi, et al. showed a greater improvement of surgical results for thoracoabdominal aorta using the adjunct, such as the distal bypass, cerebrospinal fluid drainage, and crystalloid fluid infusion into the kidneys[22]. The European followers also reported excellent clinical results of the thoracoabdominal aortic disease[23]. However, surgery for thoracoabdominal aorta still remains mountains to be conquered in the field of cardiovascular surgery. The incidence of postoperative spinal cord complications is reported to be 5 to 10%, even resulting from experienced hands, however, postoperative paraplegia occurs more frequently in the real world, especially in patients with Crawford type II extension aneurysm, higher age, and renal dysfunction. Moreover, frequent occurrence of postoperative bleeding, renal failure, gastrointestinal problems, such as ischemic colitis, and respiratory failure have greatly compromised the recovery of patients. The registry of the Japanese Association for Thoracic Surgery reported that the hospital mortality of elective surgery for thoracoabdominal aorta was 11.6% in 311 patients and that of emergent surgery was 33.3% during 2006. The US multi-center registry in 2001 disclosed that early mortality after thoracoabdominal aortic surgery was 20%!

The anatomy of spinal cord circulation was hardly known until recently. Progress in radiological imaging, such as magnetic resonance imaging or computed tomography, has elucidated details of spinal cord circulation. The well-known artery of Adamkiewicz had been one of post-mortem entity, but nowadays surgeons are informed of not only the exact location of the Adamkiewicz artery, but also the collateral blood supply to the cord preoperatively[24]. This evolution enables easier, simpler, and faster reconstruction of the intercostals arteries during thoracoabdominal aortic surgery.

Cumulative clinical experiences have provided better understandings of the intraoperative hemodynamics of the spinal cord. Although some brave surgeons are still using a "clamp-and-sew" or "clamp-and-pray" technique, the application of distal perfusion and the avoidance of proximal or distal hypotension enhanced blood supply to the cord via internal iliac, vertebral, intercostals, and lumbar arteries. Prevention of the blood-steal phenomena from the orifice of the intercostal arteries in the opened aorta maintains blood-pool reserve in the spinal cord. Animal experiments of cerebrospinal fluid drainage by Miyamoto, et al. in 1960[25] and recent randomized trials proved its efficacy for reducing spinal cord ischemia[26]. Sequential clamping of the intercostal arteries has been considered effective for enhancing the ischemic tolerance of the spinal cord. Intraoperative measurements of the motor-evoked spinal cord potentials provide an exact and instantaneous vital state of the cord. Regional or systemic hypothermia of the cord is also theoretically believed to be protective. Numerous pharmacological agents, such as papaverine, naloxene, corticosteroids, oxygen radical scavenger, prostaglandin, excitatory amino acid antagonist, and even "a nonspecific flu medicine" have been tried. Intraoperative protection of the abdominal viscera using selective perfusion, crystalloid infusion, or hypothermia has been successfully achieved.

ACUTE AORTIC DISSECTION

The acute aortic syndrome, including the acute aortic dissection and aneurysm rupture, is dreadful fatal disease and has been increasing in number. The reasons for this tide were attributed to the development of the elderly society and also to awareness of the physicians of the aortic disease for the patients with chest pain. However, early mortality of surgery for the acute aortic dissection has never become below 10% and there are still many patients dying before reaching the operating theatre.

Besides aortic rupture, the worst subset of surgical outcome in patients with acute aortic dissection is the patients group with organ malperfusion[27,28]. Patients with acute myocardial infarction in the left coronary area associated with acute type A dissection has been rarely saved unless the dissection itself was accidentally discovered during coronary angiography. Newly development of the neurological deficit is one of the highest risk factor for early death, especially patients with preoperative coma usually has tragic outcomes. Some authors proposed an intentional delay of surgery for such patients. Similarly, patients who have the malperfusion in the abdominal viscera, especially in the superior mesenteric artery, deteriorate earlier and even the emergent surgery for the aorta can not solve this problems. Recent advancement of the radiological intervention technique can sometimes revascularize the gut preoperatively and alleviate metabolic crisis. Rarely a preceding bypass surgery to the mesenteric artery turns to be successful.

Dilatation of the distal false lumen during follow-up has driven surgeons to apply total arch replacement in the acute type aortic dissection. Total arch replacement with installation of the elephant trunk into the true lumen of the descending aorta, wherever the entry site was, actually reduced the incidence of the late patency of the false lumen of the descending aorta and has resulted in a decrease of the incidence of the reoperations[29-32]. Although the outcome of the extensive arch surgery has improved, the procedure is still complicated and time-

consuming. Hybrid approach, combined open stent-grafting with the arch surgery, simplifies the strategy and has a potential to improve the late outcome[33-35].

Surgical results for acute type B dissection have never improved and is still pessimistic because indications for surgery has been strictly limited for patients with rupture or impending rupture or with organ malperfusion. Endovascular stent-grafting for acute type B dissection has been tried but failed to demonstrate the superiority over the medical treatment in the INSTEAD trial so far[36].

ENDOVASCULAR STENT-GRAFTING

Recent advance of endovascular catheter-based technology (TEVAR: thoracic endovascular aortic repair) has realized "minimally invasive" treatment for the distal arch, descending aorta, and thoracoabdominal aortic lesions. Generally, the incidence of paraplegia was averaged to 3% in endovascular intervention for extensive descending aorta, which is superior to the open surgical procedure. Ishimaru, et al. has reported that the incidence of spinal cord complications was 2.0% among patients who had endovascular stent-grafting to the descending aorta or thoracoabdominal aorta[37]. The US multi-center randomized trial of endovascular stent-grafting and open surgery for an extensive aneurysm of the descending aorta demonstrated a better result in intervention than surgery did. Using a branched endovascular stent-graft, Roselli, et al. reported a remarkable low incidence of the early mortality (1.3%) and postoperative paraplegia (2.7%) in 73 cases[38]. Muhs, et al. also reported an excellent early result of hospital death as one out of 38 patients, 2.6%, and mid-term results of 13% mortality within 1 year[39]. There was no cord complication in their series. Although in a limited number of patients, the hybrid-therapy for thoracoabdominal aorta, such as endovascular stenting and extra-anatomical bypass for the visceral arteries, has gained reasonable success. The contra-indications to the TEVAR definitely do exist in patients with chronic aortic dissection, tortuous aorta, shaggy aorta, small peripheral arteries (which exclude stent access), and shock state as a result of aneurysm rupture. Also, the long-term results of TEVAR are not optimal. Nevertheless, many cardiovascular surgeons are looking at the achievement of TEVAR in thoracoabdominal aorta with a bitter jealous admiration. The medicine world is aiming to be less invasive to the patients, and this trend is inevitable. Some innocent pessimists tend to think that shrewd cardiologists and radiologists will overtake surgeons in treating patients with aortic aneurysms. However, the disease itself is best treated by personnel who know the disease best. We, surgeons, have been trained to manage patients with aortic aneurysms, and we know the aneurysm better both externally and internally more than other medical counterparts. Also, we have been taking care of aneurysm patients on a daily basis for a long time. Only we are able to treat patients who have had complications caused by TEVAR, such as perforation, rupture, dissection, occlusion, and esophageal or bronchial fistula. We must evolve and thrive for new technology to adapt ourselves to a new paradigm in treating patients with the aortic disease. We must educate and train our young fellows to open a new frontier in the new field of surgery. There is no time for nostalgic crying for the good old days. Things are not what they used to be, and the times are changing like rolling stones.

INTRODUCCIÓN

Con el aumento de la edad media poblacional ha aumentado el número de pacientes diagnosticados de enfermedad de la aorta. Los avances en las técnicas diagnósticas facilitan el diagnóstico. Los resultados de la cirugía han mejorado por el avance tecnológico, conocimiento de la enfermedad, prótesis no porosas, protección neurológica y desarrollo de endoprótesis.

Según el registro de la Asociación Japonesa de Cirugía Torácica desde 1984, las intervenciones en cirugía de la aorta torácica han aumentado de 712 en 1984 a 9.876 en 2006[1,2]. En 2006 se implantaron 617 endoprótesis (Fig. 3). La mortalidad de la sustitución electiva del arco es del 6,7% y la mortalidad de la cirugía urgente por disección tipo A del 13,4% en 2006 (Figs. 4-7). Ha habido cambios de estrategia por opciones como endoprótesis o intervenciones híbridas. Los cirujanos deben conocerlas y poder aplicarlas. La Sociedad Española de Cirugía Torácica y Cardiovascular ha organizado el Grupo de Trabajo de la Aorta, que va a publicar una monografía sobre el tratamiento quirúrgico de las enfermedades de la aorta. Este grupo, coordinado por Calbet y Mestres, editor-jefe, ha preparado una completa revisión. La Sociedad Española debe ser felicitada por esta apropiada revisión.

RAÍZ Y AORTA ASCENDENTE

El «patrón oro» sigue siendo la operación de Bentall-De Bono desde 1968[1]. Las complicaciones de la anti-

coagulación y fallos protésicos han favorecido las intervenciones preservadoras de la válvula como el remodelado de Yacoub[2] y la reimplantación de David[3], para pacientes con cúspides normales y dilatación del tracto de salida izquierdo, senos de Valsalva y unión sinotubular.

El debate sobre la superioridad de estos procedimientos confirma que la dilatación del anillo basal y triángulo intercúspide no recomienda estas operaciones en pacientes jóvenes con síndrome de Marfan. El remodelado es mejor si no hay dilatación del anillo basal y unión sinotubular. En esta operación la prótesis de dacrón no tiene los efectos fisiológicos de los senos de Valsalva. Hay muchas modificaciones como las de Cochran, De Paulis, David V, Stanford y Gleason[4-8], sin que hayan demostrado superioridad sobre el injerto recto. Otro reto es el de los velos anormales, ya que hay frecuente prolapso de velos. Todavía faltan resultados alejados consistentes de plicaturas y refuerzos.

Un tema adicional es disminuir el umbral de diámetro para la sustitución de aorta ascendente. El destino final de la aorta dilatada es la ruptura y disección. Los pacientes con síndrome de Marfan o válvula bicúspide han fallecido prematuramente por estas causas. El consenso general en este grupo es la intervención a partir de 4,0-4,5 cm[9].

PROTECCIÓN CEREBRAL

La protección cerebral y una anastomosis segura son dos principios básicos. Una causa de infarto cerebral postoperatorio es la embolia de material aterosclerótico de trombos, placas, anastomosis y cánulas y pinzas de oclusión. Una búsqueda meticulosa de ateromas mediante TC y ecocardiograma pre e intraoperatorio proporciona información para la estrategia de canulación y oclusión. Si bien se prefiere la perfusión anterógrada aórtica, en algunos casos la ateromatosis hace variar y seleccionar las arterias femoral o axilar[10]. La axilar a veces causa ateroembolias por lesiones proximales del tronco braquiocefálico[11,12].

La protección cerebral contra la isquemia es un tema antiguo, siendo la mejor protección teórica la perfusión cerebral anterógrada; sin embargo, las incertidumbres de la circulación cerebral condujeron al desarrollo de la hipotermia y parada circulatoria, al ser la hipotermia profunda el método más fiable de protección cerebral[13-15]. La perfusión anterógrada selectiva de troncos supraaórticos con hipotermia profunda o moderada consigue una protección segura durante una CEC prolongada, a pesar de una posible incidencia de embolización más elevada[16]. La técnica «primero el arco» con hipotermia profunda simple tiene resultados similares[17]. No queremos argumentar cuál es el mejor método, y lo que queremos es el mejor resultado para los pacientes. Los resultados de la sustitución del arco en instituciones líderes tienen mortalidades del 3-7%, y 5% de infarto cerebral.

ANEURISMAS TORACOABDOMINALES

La cirugía de la aorta toracoabdominal se inició antes de la CEC. De Bakey comunicó en 1965 una mortalidad del 26% en 42 casos con aneurisma toracoabdominal y reconstrucción extraanatómica sin CEC[18]. Crawford, et al.[19] modificaron y simplificaron la intervención con la técnica de inclusión, con mortalidades del 8% hacia 1978. Clasificaron los aneurismas toracoabdominales en cuatro categorías de acuerdo con la extensión y mostraron mortalidades del 10,7% y déficit neurológico del 28,3% en el tipo II[20]. Los «hijos» de Crawford confirmaron el progreso en esta cirugía, ya que Coselli, et al.[21] comunicaron una enorme serie de aneurismas toracoabdominales con resultados excepcionales. Safi, et al.[22] publicaron la mejora de sus resultados con la utilización de derivación izquierda y drenaje de LCR. En Europa también se han publicado buenos resultados[23], si bien la cirugía de la aorta toracoabdominal continúa siendo un reto. La incidencia de complicaciones medulares es del 5-10%, incluso en las mejores manos, y la paraplejía en el mundo real es más frecuente en los aneurismas tipo II y en personas añosas e insuficiencia renal. El registro de la Asociación Japonesa de Cirugía Torácica comunica una mortalidad de la cirugía toracoabdominal electiva del 11,6% en 311 pacientes y del 33% en pacientes urgentes en 2006. El registro multicéntrico de EE.UU. en 2001 comunicó una mortalidad precoz del 0%.

La anatomía de la circulación espinal se conoce desde hace poco. Los progresos en las técnicas de imagen como la RM y la TC han aportado importantes detalles. La conocida arteria de Adamkiewicz fue una entidad *post mortem,* pero en la actualidad disponemos de su localización y de circulación colateral[24], lo que favorece una reconstrucción facilitada de las intercostales. La experiencia ha proporcionado mejor entendimiento de la hemodinámica medular intraoperatoria. Si bien algunos cirujanos todavía utilizan las técnicas *clamp-and-sew* o *clamp-and-pray,* la aplicación de perfusión distal y evitar la hipotensión proximal mejora la perfusión medular a través de las ilíacas internas, vertebrales, intercostales y lumbares. La prevención de robo intercostal en la aorta abierta mantiene la reserva medular. Los experimentos de Miyamoto, et al. en 1960[25] sobre drenaje de LCR y estudios aleatorizados recientes[26] demuestran su

eficacia en la reducción de la isquemia medular. La oclusión secuencial aumenta la tolerancia a la isquemia, y la medición de potenciales evocados motores informa del estado de la médula. Se han utilizado fármacos como papaverina, naloxona, esteroides, prostaglandinas, y se ha mejorado la protección visceral abdominal.

DISECCIÓN AÓRTICA AGUDA

El síndrome aórtico agudo, incluyendo disección y ruptura, es una enfermedad fatal frecuente. Las razones pueden ser el envejecimiento de la población y el grado de sospecha de los médicos. La mortalidad de la cirugía de la disección aguda nunca ha bajado del 10%. Además de la ruptura, el peor grupo de pacientes es el que presenta malperfusión[27,28]. Los pacientes con infarto agudo de la coronaria izquierda asociado con disección tipo A raramente se salvan, a no ser que sea un hallazgo casual. Un factor de riesgo de muerte precoz es el daño neurológico, y en especial el coma. Los pacientes con malperfusión abdominal se deterioran con rapidez, y ni siquiera la intervención urgente puede resolver los problemas. Las técnicas radiológicas pueden a veces revascularizar el intestino y mejorar la crisis metabólica.

La dilatación de la falsa luz ha ocasionado que se proponga la sustitución del arco en la intervención inicial, incluyendo una «trompa de elefante» en la luz verdadera. Esto parece haber disminuido la incidencia de permeabilidad de la falsa luz en el seguimiento reduciendo la incidencia de reoperación[29-32]. Sin embargo, el procedimiento sigue siendo largo y complicado. El abordaje híbrido, combinando la cirugía del arco y endoprótesis, simplifica la estrategia y podría mejorar los resultados[33-35].

Los resultados quirúrgicos en la disección aguda tipo B nunca han mejorado, y todavía somos pesimistas, ya que las indicaciones operatorias se han limitado a pacientes con ruptura o malperfusión. La terapia endovascular en el tipo B agudo no es superior al tratamiento médico, según los resultados del estudio INSTEAD[36].

TERAPIA ENDOVASCULAR

Los avances de la terapia basada en catéteres (TEVAR, *thoracic endovascular repair*) posibilita un tratamiento menos agresivo del arco distal, aorta descendente y toracoabdominal. La incidencia de paraplejía es del 3% en la aorta descendente, lo que es algo mejor que en la cirugía abierta. Isshimaru, et al.[37] han comunicado una incidencia de complicaciones espinales del 2,0%. El estudio aleatorizado multicéntrico de EE.UU. entre terapia endovascular y cirugía abierta para aneurismas descendentes ha demostrado mejor resultado en la intervención que en la cirugía. Utilizando endoprótesis con ramas, Roselli, et al. han comunicado una mortalidad baja (1,3%) y paraplejía (2,7%) en 73 casos[38]. Muhs, et al. una muerte hospitalaria en ocho casos, y 13% de mortalidad al año[39]. Si bien, en un número limitado de pacientes, la terapia hibrida para los aneurismas toracoabdominales con endoprótesis y derivaciones extraanatómicas viscerales ha tenido cierto éxito. Las contraindicaciones para TEVAR existen en pacientes con disección crónica, aorta tortuosa, arterias distales pequeñas y estado de *shock* en casos de ruptura, y los resultados alejados no son óptimos. Muchos cirujanos cardiovasculares observan TEVAR con celosa admiración. La medicina intenta ser menos agresiva, y esta tendencia es inevitable. Algunos inocentes pesimistas tienden a pensar que los cardiólogos y los radiólogos reemplazarán a los cirujanos en el tratamiento de los aneurismas de la aorta. Sin embargo, esta enfermedad se trata mejor por los que mejor la conocen. Nosotros, los cirujanos, hemos sido entrenados en el tratamiento del paciente con aneurisma de la aorta y conocemos tanto por dentro como por fuera el aneurisma mejor que cualquier otro colega. Asimismo, tratamos a pacientes con aneurismas a diario durante mucho tiempo. Sólo nosotros somos capaces de tratar a pacientes que tienen complicaciones de TEVAR como perforación, ruptura, disección, oclusión y fístula bronquial o esofágica. Debemos evolucionar y adoptar nuevas tecnologías y adaptarnos al nuevo paradigma de tratamiento de la enfermedad de la aorta. Debemos educar y entrenar a nuestros jóvenes para abrir una nueva frontera en el nuevo campo de la cirugía. No hay tiempo para recuerdos nostálgicos de los antiguos buenos tiempos. Las cosas no son como fueron, y los tiempos cambian.

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