



MINISTRY OF  
HEALTH & WELFARE

**khIDI** Korea Health Industry  
Development Institute



**SMART CARE**

**Heart**

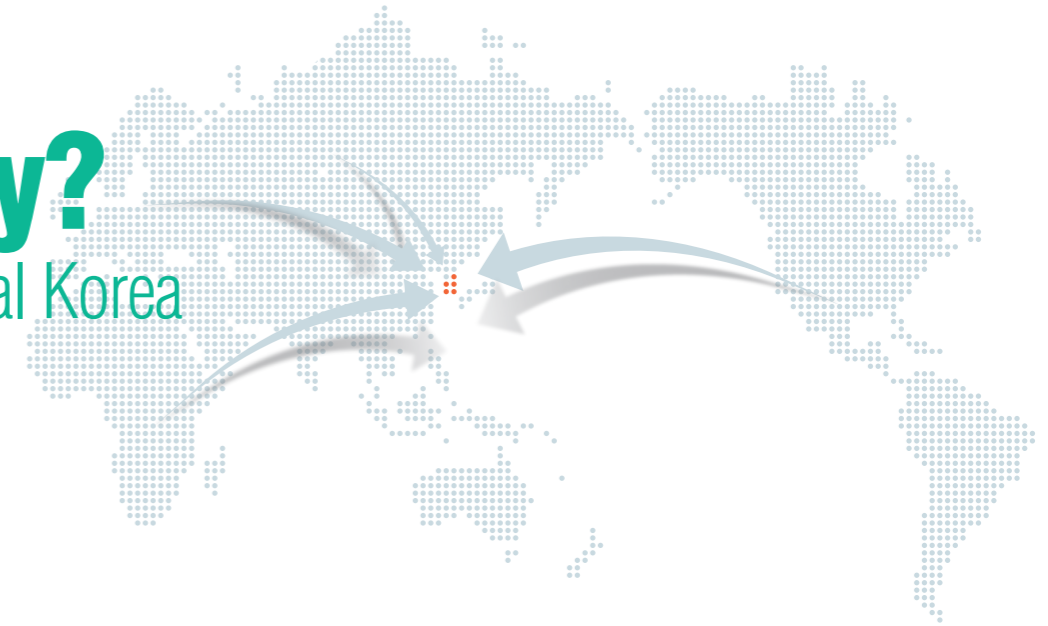
**Korea**, Global Leader in  
Cardiovascular Disease Treatment



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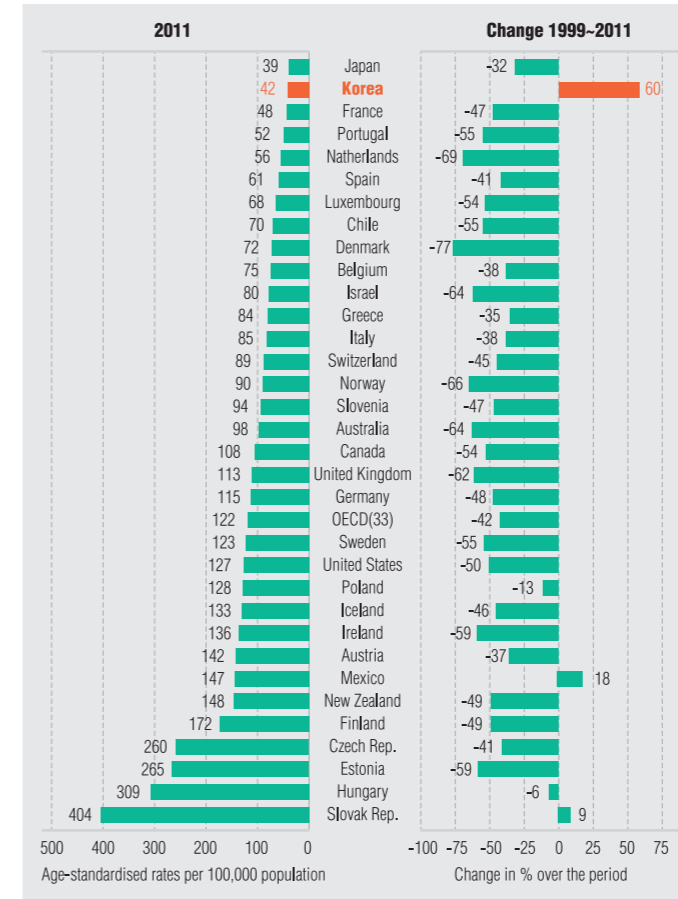
# Why? Medical Korea



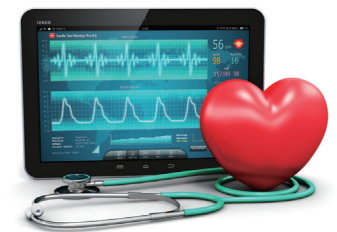
## World-class treatment of Ischemic Heart Disease

- + Ischemic heart disease mortalities in Korea stand at 42 people per 100,000 population, extremely lower than the OECD average(122 people per 100,000 population)
- + Mortality in Korea related to ischemic heart disease has been decreasing rapidly since 1990
  - The mortality rate due to ischemic heart disease in Korea has decreased 60% on average every year since 1990, thanks to the development of a revolutionary treatment.
- + Factors in the development of cardiac infarction treatment
  - The introduction of CCU (Coronary Care Unit)
  - The advancements in CABG (Coronary Artery Bypass Grafting) and PCI (Percutaneous Coronary Intervention)
  - The development of state-of-the-art medical equipment and coronary stents

[Ischemic heart disease mortality]



(Source: OECD, Health at a Glance 2013)

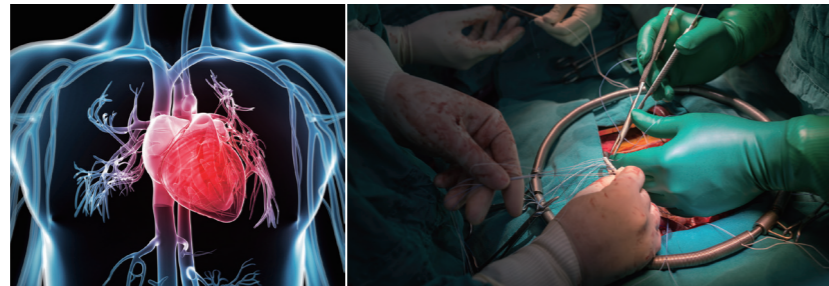


## Korea, the country that saves lives

- + Korea achieved its first successful artificial cardiopulmonary bypass surgery in 1959 through the Minnesota project
  - South Korean doctors save the lives of foreign patients in Korea, and teach and train overseas doctors
- + From 1984 to late 1990s: With the establishment of the Korea Heart Foundation, Korea's cardiac surgery technologies strived to develop surgical solutions for congenital heart defects
- + 2000s: Surgeries on acquired heart diseases such as coronary artery diseases or valvular diseases increased significantly
- + Now, Korea has gained world wide reputation for advanced cardiac surgery technologies and skills



## Why? Medical Korea



### No. 1 heart transplant success rate in the world

- + In 1992, the first successful heart transplant in Korea
- + In 2005, success in transplanting hearts and kidneys simultaneously
- + Survival rate of cardiac surgery is **99%** for short term and the 5-year survival rate is **86%**; figures that are higher than those of any other country in the world
- + In 1997, the first successful heart transplant for an infant having **0%** of the early recorded mortality rate

[Korea's heart transplant status]

(Unit : case)

| Total | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------|------|------|------|------|------|------|------|------|------|------|------|
| 843   | 12   | 29   | 50   | 84   | 65   | 73   | 98   | 107  | 127  | 118  | 80   |

(Source : <https://www.konos.go.kr>)

### 1-2days minimal hospitalization for Percutaneous Coronary Intervention (PCI)

- + Thanks to advances in coronary intervention techniques and the development of a variety of stents, Korea's PCI success rate reached **93%**
- + The mortality rate of myocardial infarction patients in Korea is **4.9%**, which is lower than that of advanced countries (5 to 7%)
- + The incidence of MACE (Major Adverse Cardiac Events) in Korea is **12.7%**, which is far lower than that of advanced countries (20%)

### Reduced mortality rate through surgery and interventional procedures in congenital heart defects

- + Korea is reducing the mortality and hospitalization period by applying surgical and interventional treatment, less than **1%** of the mortality rate of patients
  - The mortality rate of patients with TOF (Tetralogy of Fallot) within the first month after surgery is only 0.6%
  - The mortality rate of patients with interventricular septal defect within the first month after surgery is only 0.6%
  - The mortality rate of patients with atrial septal defects is 0.5%

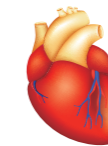
[Mortality rate of congenital heart defect treatment in Korea]

|              | Ventricular Septal Defect | Atrial Septal Defect | Tetralogy of Fallot | Arterial Switch Operation | Coarctation of Aorta/Interrupted aortic arch | Hypoplastic Left Heart Syndrome |
|--------------|---------------------------|----------------------|---------------------|---------------------------|--|---------------------------------|
| <b>KOREA</b> | <b>0.6%</b>               | <b>0.5%</b>          | <b>0.6%</b>         | <b>3.7%</b>               | <b>1.9%</b>                                  | <b>12.9%</b>                    |
| U.S.A        | 0.7%                      | 0.6%                 | 1.4%                | 2.6%                      | 1.2%   | 15.7%                           |
| England      | 0.4%                      | 0.3%                 | 0.9%                | 2.4%                      | 1.9%   | 12.3%                           |

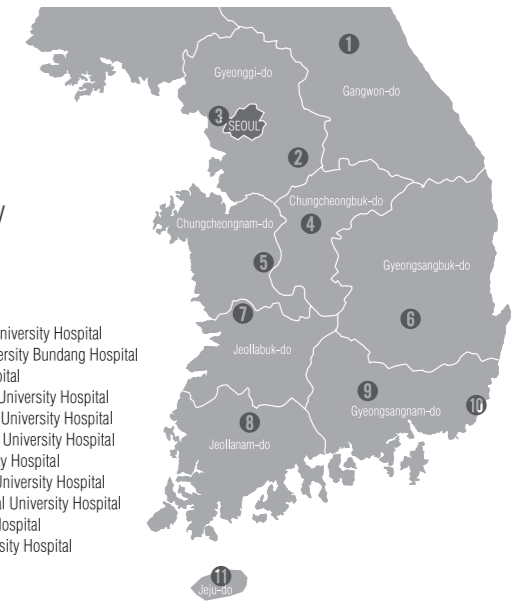
(Source : KHIDI, 2014)

### Establishment and operation of 11 designed Cardiac and Cerebral vascular Disease Centers by the government

- + Korean government established a plan for the 'Institution and Operation of Cardiac and Cerebral Vascular Disease Centers' in 2008
- + Providing appropriate medical treatment to cardiovascular disease patients in the initial stage in timely manner so as to increase the treatment performance
- + **96%** of the patients takes less than 120 minutes, between arriving to an emergency room to receiving primary coronary angiography
- + Cardio-Cerebrovascular disease centers have been in operation in 11 districts across the country (24-hour operation)
- + Providing professional treatment services in a timely manner, including CP (Critical Pathway) development and distribution, and early rehabilitation



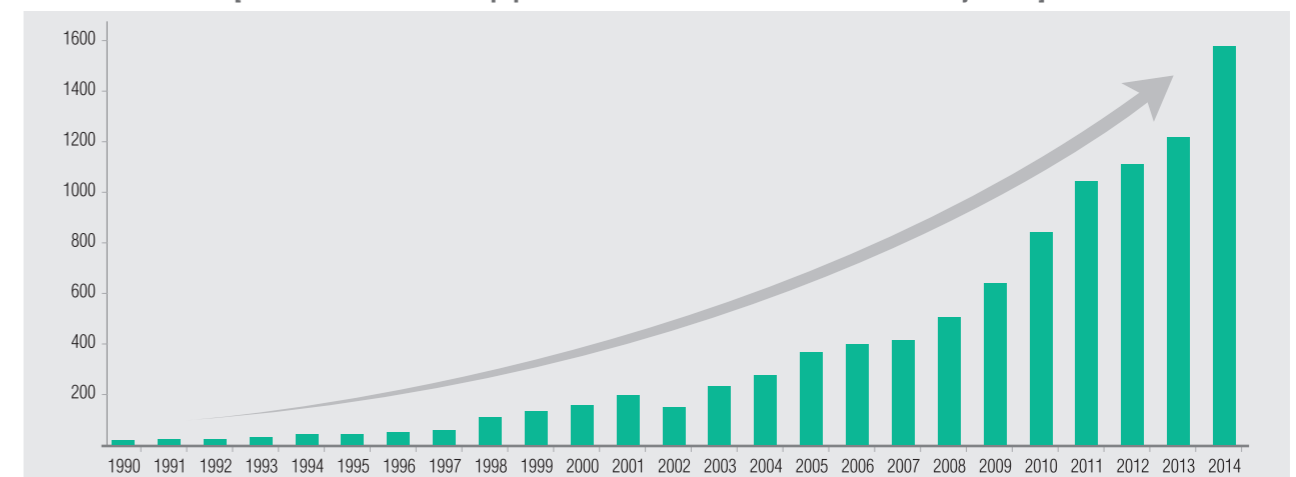
- 1 Kangwon National University Hospital
- 2 Seoul National University Bundang Hospital
- 3 Inha University Hospital
- 4 Chungbuk National University Hospital
- 5 Chungnam National University Hospital
- 6 Kyungpook National University Hospital
- 7 Wonkwang University Hospital
- 8 Chonnam National University Hospital
- 9 Gyeongsang National University Hospital
- 10 Dong-A University Hospital
- 11 Jeju National University Hospital



### Korea's continued research produces the world-leading performance

- + Korea has provided an exemplary answer to the question regarding the appropriate medication period for patients receiving an antiplatelet agent after a stent insertion
  - Korea's treatment practice is now recommended by the US FDA and the Korean FDA
- + The number of cardiac specialists from Korea listed in the world's top 3 biographical dictionaries (Marquis Who's Who, IBC, Hippocrates) has been rapidly growing since the 2000s, and Korea is leading the world in the cardiac treatment sector

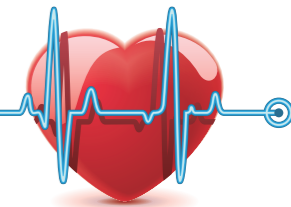
[Status of Korean research papers on cardiac diseases listed in international journals]



(Source : PubMed.gov)

# What?

Medical Korea



## Korea's advanced pediatric cardiac surgery technologies



- + Thanks to the development of echocardiography, diagnoses without cardiac catheterization have become possible, and the medical procedure using balloons replaces the surgery on pulmonary stenosis
- + As patients receiving surgery are younger and surgery performance improves, patients are able to enjoy an average life expectancy and an improved quality of life

### 1 Ventricular septal defect surgery

- This is a surgery that closes the hole on the interventricular septum between the right ventricle and the left ventricle using artificial materials
- In Korea, the success rate is **99.4%** for this surgery, and the average hospitalization period is 20.9 days

### 2 TOF (Tetralogy of Fallot) treatment depends on the proficiency of medical staff

- TOF (Tetralogy of Fallot) is a congenital heart defect featuring 4 anatomical abnormalities: right ventricular outflow obstruction, ventricular septal defect, aortic overriding and right ventricular hypertrophy
- In Korea, the success rate of TOF surgery is **99.4%**, and the average hospitalization period is 16.1 days

### 3 Treatment of transposition of great arteries

- The treatment for the transposition of great arteries is to correct the reversed connection between ventricles and large vessels
- In Korea, aorta replacement has a success rate of **99.3%** and an average hospitalization period of 16.1 days

### 4 Fontan surgery

- This method is to connect the right atrium and the pulmonary artery directly when the right ventricle doesn't function. It is applicable to right ventricular hypoplasia patients, tricuspid atresia patients and single ventricle patients
- Recently, a medical technique has evolved to connect the vena cava to the pulmonary artery using a graft
- In Korea, the average hospitalization period is 19.7 days and the success rate is **99.9%**
- The survival rate of patients who received surgery on a single ventricle accompanying isomeric syndrome in Korea is **73%**, which is much better than that of other advanced countries such as the United States (53%), Japan (68%) and France (69%)

### 5 Aortic coarctation treatment

- The more severe the symptoms of aortic coarctation are the more quickly the infant patient requires surgical treatment after birth
- The surgery success rate has reached **98.1%**

### 6 Intervention treatment of pediatric cardiology

- In particular, the mortality rate for patients receiving the interventional closure procedure, balloon expansion procedure or stenting procedure in Korea is less than 1%, which is outstanding
- If surgical treatment is necessary due to changes in the condition of the patient while in interventional treatment, thoracotomy can be performed immediately by a hybrid surgical team on standby
- In Korea, the success rate is **99.5%**

# 1

## Treatment of congenital heart defects



### Korea achieved success in open heart surgery for extremely low birth weight infants

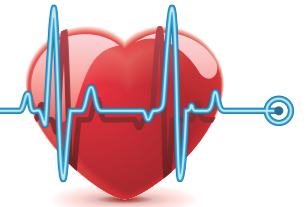
- + Open heart surgery can be applicable to most congenital heart defect patients which enables to lead a normal life
- + Open heart surgery is a surgical method to treat the heart by opening the chest. Although this is difficult to perform on premature babies weighing under 1,200g, Korea has achieved numerous surgical successes on infants with extremely low weight.

[Annual Number of Congenital Cardiac Surgery Cases and Mortality Rates in Korea]



(Source: Korean Society for Thoracic & Cardiovascular Surgery)

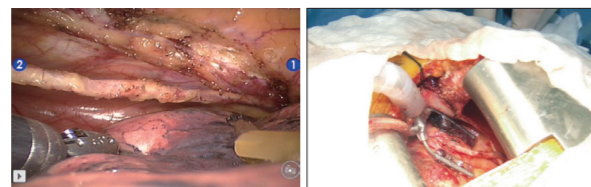




## 2 Treatment of acquired heart disease

### World's leading coronary artery bypass technologies

- + Korea features a relatively high level of OPCAB (Off-Pump CABG)
- + In addition to the stability and effectiveness of OPCAB, a number of studies are being performed on the opening of graft, on surgical techniques using a complete arterial catheter, on minimally invasive surgical techniques, and on protecting the brain using techniques that involve no touching of the aorta
- + About 2000 cases of coronary artery bypass are performed annually, and the mortality rate is only 2 to 3%, which is similar to the mortality rate of 2.5% provided by the US STS (Society of Thoracic Surgeons)
- + Coronary artery bypass surgery requires an average hospitalization period of 20 days and OPCAB requires an average hospitalization period of 15 days with a mortality rate under 1%



Coronary artery bypass surgery using a robot (Internal thoracic artery sampling scene) MIDCAB(Minimally Invasive Direct Coronary Artery Bypass) surgery scene

[Annual Number of Coronary Artery Bypass Surgeries and Mortality Rates in Korea]

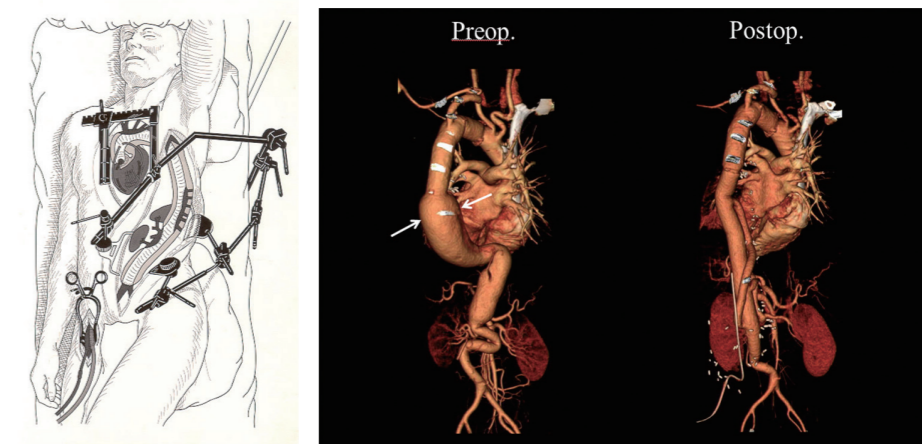


(Source: Korean Society for Thoracic & Cardiovascular Surgery)

### Aortic surgery contributes to outstanding long term survival rate

- + In parallel with the increase in the average lifespan, the adoption of a more Western diet in Korea has also increased the prevalence of aortic diseases, requiring more aortic surgeries
- + State-of-the-art medical techniques such as complicated surgery on aortic arch, intravascular stenting, grafting and hybrid surgical technologies are emphasized
- + Aortic aneurysm is subjected to surgery when its size is enlarged or pain is generated, or symptoms of rupture are observed
- + Surgery is performed by replacing the damaged vessel with an artificial vessel through surgical thoracotomy, or through percutaneous stenting or grafting, or with a hybrid surgical procedure
- + Although aortic surgery is complicated and takes a longer period of time, it delivers an outstanding long term survival rate, so this method is widely used as the primary treatment method for aortic diseases
- + In Korea, over 1,000 cases of aortic surgery are performed annually and the average mortality rate and hospitalization period are 4.7% and 19 days, respectively

[Annual Number of Aortic Surgery Cases and Relevant Mortality Rates in Korea]



[The number of annual aortic surgery cases and relevant mortality rate in Korea]



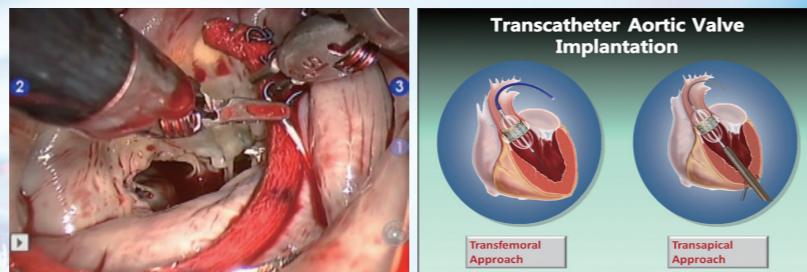
(Source: Korean Society for Thoracic & Cardiovascular Surgery)





### Valve surgery with world-leading performance

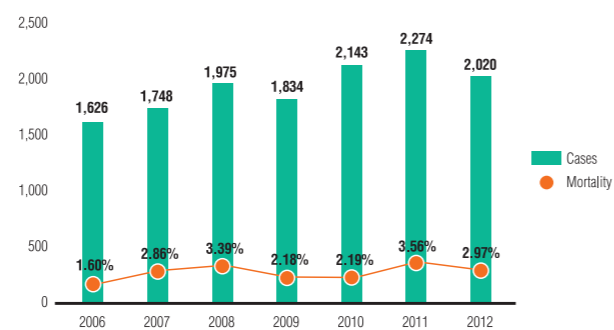
- + Over 2,000 cases of valve surgery are performed at Korean medical institutions annually with a mortality rate of 2 to 3 %, far less than that of the United States (5 to 7%), demonstrating Korea's excellence
- + The mortality rate of patients receiving surgery from Korea's major medical institutions is approximately 1.5% and the average required hospitalization period is 19 days
- + Valve surgery can be divided into replacement and angioplasty
  - The surgical method depends on the age of the patient, the associated diseases and the consent of the patient or guardian



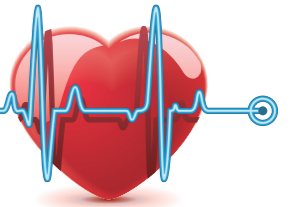
View of mitral valvoplasty using a robot

TAVI

[Annual Number of Valve Surgery Cases and Mortality Rates in Korea]

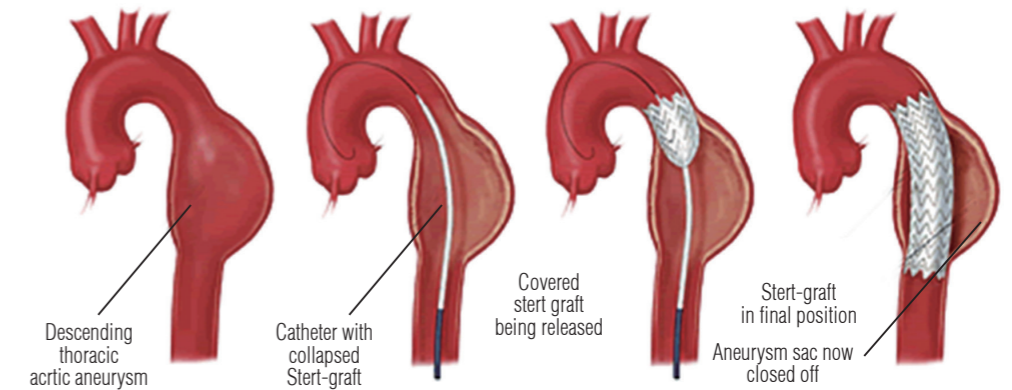


(Source: Korean Society for Thoracic & Cardiovascular Surgery)

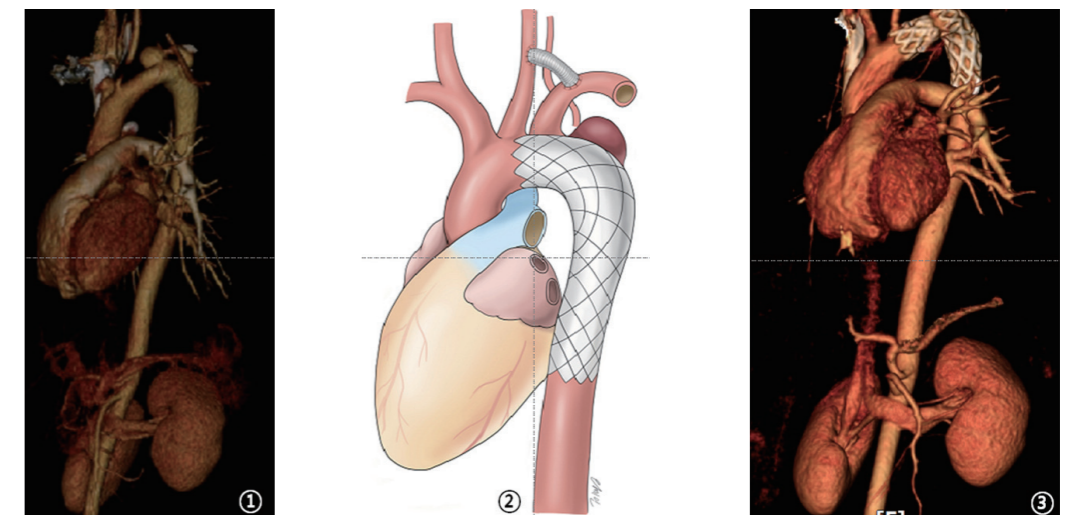


### Minimally Invasive Cardiovascular Surgery

- + Minimally invasive surgery is widely used in coronary artery bypass, congenital cardiac surgery and mitral valvular surgery
- + A wide range of minimally invasive surgical techniques can be used for minimal scarring: endoscopy, thoracoscopic methods using special equipment operated by voice-recognition software, Da Vinci surgical robots, etc.
- + Minimally invasive surgery requires special equipment and experienced medical staff to maintain the minimal invasive extracorporeal circulation, and require a CT scan to check the state of peripheral blood vessels for tube insertion before surgery
- + Advantages of minimally invasive surgery: cosmetic excellence, rapid recovery, less pain and fewer long-term complications



[Stenting - Grafting for aortic aneurysm]



[Hybrid TEVAR(2) for thoracic aortic aneurysms (1) and CT footage after surgery (3)]



What?  
Medical Korea



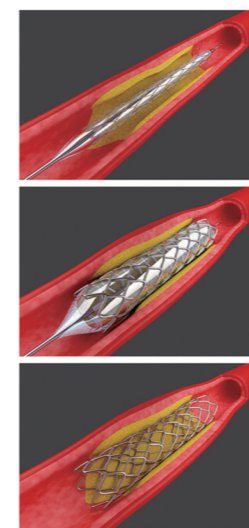
# 3

## Intervention of acquired cardiac disease



### Complications minimized thanks to more than 30 years of experience

- + Since the initial introduction of cardiovascular intervention to Korea in 1987, Korea has been performing tens of thousands of procedures using not only new treatment skills such as balloon angioplasty, stenting or coronary atherectomy, but also new medical devices such as intravascular ultrasound, doppler guidewire and pressure guidewire
- + After light sedation, interventions performed to cure coronary artery diseases approach the problematic coronary artery with a guidewire and catheter through the femoral artery or radial artery to expand the narrowed area
- + As this method requires a shorter hospitalization period and simple treatments, multiple performances of these procedures are available



### Korea's cardiovascular intervention skills go global

- + Diagnostic coronary angiography rarely causes surgical complications and generates a mortality rate of only 0.14 to 0.75%
- + After diagnostic coronary angiography, coronary intervention is performed. The mortality rate of patients with acute myocardial infarction who receive this procedure is only 1.2 to 5.5% in Korea, which is similar to that of the United States (3.5%).
  - The rate of recurrence within 1 year is 2.5 to 9.5%, and the average hospitalization period is 3.0 to 9.5 days, closely matching statistics in the United States and European countries
- + Angina patients generally experience complicated lesions and stenosis in multiple areas due to the chronically developed disease
  - The mortality rate, the rate of recurrence within 1 year and the hospitalization period in Korea are 0.1 to 1.4%, 2.4 to 6.0% and 1.7 to 4.0 days, respectively
- + Even Korea's medical technologies to treat left main vessel diseases or chronic total occlusion, which used to be difficult to treat surgically, are setting the global standard. An increasing number of foreign physicians are visiting Korea to learn Korea's techniques every year.

#### 1 Coronary angiography

- Coronary angiography is a medical examination that injects a contrast medium to identify the location and degree of coronary artery narrowing
  - This is essential for balloon dilatation or stenting, the most accurate method for diagnosing angina pectoris or myocardial infarction
- After inserting a thin plastic catheter with a diameter of 2 to 3mm to the cardiac coronary artery via the femoral artery or radial artery, the contrast medium is injected into the coronary artery and images are taken

#### 2 Balloon dilatation

- Balloon dilatation is the medical procedure for facilitating blood flow by inflating a balloon inserted in the narrowed coronary artery identified by coronary angiography
- Recently a method of stenting has been widely used
- If the inner diameter of the vessel is too narrow to allow the insertion of a stent, dilatation is performed using a balloon coated with a drug (to avoid granulation) to prevent the re-narrowing of the dilated vessel

#### 3 Stenting

- Stenting is a method of inserting a stent (metal net) to prevent the vessel from being re-narrowed
- As blood clots may be generated from the reaction of the body to the foreign substance (stent), and granulation may be observed inside the stent, a new stent thrombosis technique has been developed and is presently being used to gradually discharge a drug suppressing granulation on the stent
  - Although stent thrombosis is remarkably successful at reducing restenosis, it may cause blood clots to develop in the stent due to delays in the healing of the inner wall of the stented vessel; consequently, the patient is required to receive an antiplatelet agent for at least 1 year
  - Recent stent technologies make the metal body of stent disintegration



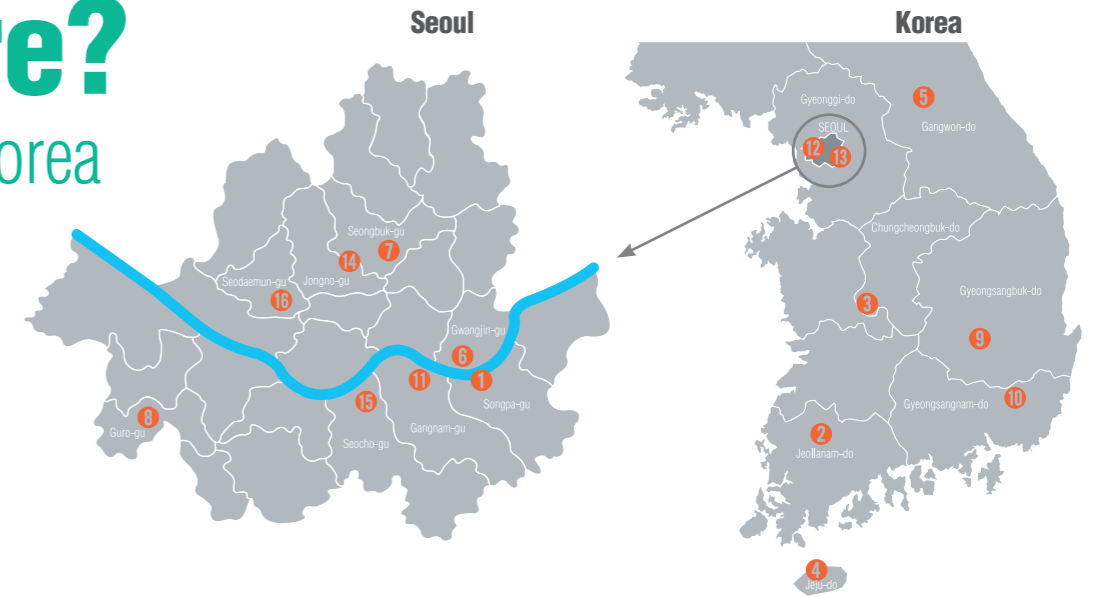
# How?

## Medical Korea



# Where?

## Medical Korea



### Symptom



#### If you experience chest pain, shortness of breath or sudden chest pain, go to the nearest hospital

If one experiences any of the following symptoms due to an insufficient supply of oxygen that is a consequence of narrowed vessels or necrosis of adjacent tissues, visit the nearest hospital immediately for consultation and examination. Before visiting a Korean medical institution, patients are required to be treated by a local doctor in order to reduce the risk of mortality.

### Checkup



#### Diagnosable with electrocardiogram and echocardiography

If cardiac disease is suspected, the state of the heart and vessels must be checked at the nearest hospital through electrocardiogram or echocardiography, and then a Korean medical institution should be visited for more precise examination and treatment.

- Electrocardiogram
- Myocardial test
- Echocardiography
- Nuclear medicine test
- Cardiac chest computed tomography(CT), Cardiac magnetic resonance imaging (MRI)
- 24-hour Holter test
- Exercise stress test
- Coronary angiography

### Go to Medical Korea



#### International Healthcare Center Services

Major medical institutions in Korea offer international healthcare centers to provide medical services for foreign patients. These services include interpretation, medical reception and request service, customized care service, visa extension service, airport pickup service, and a 24-hour call service, all of which are intended to ensure prompt medical services for international patients.

## Major Cardiac Centers of Korea

### 1 Asan Medical Center (since 1989)

- **Major treatment.** Cardiac Surgery, Cardiology
- **Address.** 88, Olympic-ro 43-Gil, Songpa-Gu, Seoul 138-736, Korea
- **Tel.** 82-2-3010-5001
- **E-mail.** int@amc.seoul.kr
- **Homepage.** <http://eng.amc.seoul.kr>
- **Language Service.** English, Chinese, Russian, Arabic, Mongolian, Japanese

### 2 Chonnam National University Hospital (since 1910)

- **Major treatment.** Cardiac Surgery
- **Address.** 42 Jebongro, Dong-gu, Gwangju, 501-757, Korea
- **Tel.** 82-62-220-6016
- **E-mail.** ykyungy@hanmail.net
- **Homepage.** <http://eng.cnuh.co.kr>
- **Language Service.** English, Russian

### 3 Chungnam National University Hospital (since 1995)

- **Major treatment.** Cardiology
- **Address.** 282, Munhwa-ro, Jung-gu Daejeon, 301-721, Korea
- **Tel.** 82-42-280-8292
- **Homepage.** <http://www.cnuh.co.kr>
- **Language Service.** Russian

### 4 Jeju National University Hospital (since 2001)

- **Major treatment.** Cardiology
- **Address.** Aran 13gil 15, Jeju-si, Jeju Special Self-Governing Province, Korea
- **Tel.** 82-64-717-1652
- **E-mail.** ynm78@hanmail.net
- **Homepage.** [http://www.jejunuh.co.kr/eng/01\\_sub01.jsp](http://www.jejunuh.co.kr/eng/01_sub01.jsp)
- **Language Service.** English, Chinese, Russian, Japanese

### 5 Kangwon National University Hospital (since 2000)

- **Major treatment.** Cardiac Surgery, Cardiology
- **Address.** Baengnyeong-ro 156, Chuncheon-Si, Gangwon-Do, 200-722, Korea
- **Tel.** 82-33-258-9003
- **Homepage.** <http://www.knuh.or.kr/eng/>
- **Language Service.** English, Russian

### 6 Konkuk University Medical Center (since 1982)

- **Major treatment.** Cardiac Surgery
- **Address.** 120-1 Neungdong-ro(Hwayang-dong), Gwangjin-gu, Seoul 143-729, Korea
- **Tel.** 82-2-2030-8362
- **Homepage.** <http://www.kuh.ac.kr/english>
- **Language Service.** English, Chinese, Japanese

### 7 Korea University Anam Hospital (since 1938)

- **Major treatment.** Cardiac Surgery, Cardiology
- **Address.** 73, Inchon-ro, Seongbuk-gu, Seoul, 136-705, Korea
- **Tel.** 82-2-920-5677
- **Homepage.** <http://anam.kumc.or.kr/language/ENG/main/index.do>
- **Language Service.** English, Chinese, Russian, Mongolian

### 8 Korea University Guro Hospital (since 1983)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiology
- **Address.** 148, Gurodong-ro, Guro-gu, Seoul, 08308 Korea
- **Tel.** 82-2-1577-9966
- **Homepage.** <http://guro.kumc.or.kr/language/ENG>
- **Language Service.** English, Chinese, Japanese

### 9 Kyungpook National University Hospital (since 1910)

- **Major treatment.** Cardiology
- **Address.** 130 Dongdeok-ro, Jung-gu, Daegu 700-721, Korea
- **Tel.** 82-53-200-5053
- **Homepage.** <http://eng.knuh.kr/main/>
- **Language Service.** English, Chinese, Japanese

### 10 Pusan National University Yangsan Hospital (since 2008)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 20, Geumo-ro, Mulgeum-eup, Yangsan-si, Gyeongsangnam-do, Korea
- **Tel.** 82-55-360-2011
- **E-mail.** hyeyoung@pnuyh.co.kr
- **Homepage.** <http://www.pnuyh.co.kr>
- **Language Service.** English, Russian, Mongolian

### 11 Samsung Medical Center (since 1994)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 81 Inwon-ro, Gangnam-Gu, Seoul, 135-710 Korea
- **Tel.** 82-2-3410-0200
- **Homepage.** <http://english.samsunghospital.com/main/english.do>
- **Language Service.** English, Chinese, Russian, Arabic, Mongolian, Japanese

### 12 Sejong General Hospital (since 1981)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 28, 489 gil Hohyeon-ro Sosa-gu Bucheon-si Gyeonggi-do 422-711 Korea
- **Tel.** 82-32-340-1468
- **Homepage.** <http://en.sejongh.co.kr>
- **Language Service.** English, Russian, Mongolian

### 13 Seoul National University Bundang Hospital (since 2003)

- **Major treatment.** Cardiac Surgery, Cardiology
- **Address.** 82, Gumiro 173beon gil, Bundang gu, Seongnam-si, Gyeonggi-do, 463-707, Korea
- **Tel.** 82-31-787-2034
- **E-mail.** ihsi@snubh.org
- **Homepage.** <http://www.snubh.org/dh/en>
- **Language Service.** English, Chinese, Russian, Arabic, Mongolian, Japanese

### 14 Seoul National University Hospital (since 1978)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 101 Daehak-ro, Jongno-gu, Seoul, 03080, Korea
- **Tel.** 82-2-2072-0505
- **E-mail.** international@snuh.org
- **Homepage.** <http://snuh.org/english>
- **Language Service.** English, Chinese, Russian, Mongolian, Japanese

### 15 Seoul St. Mary's Hospital, The Catholic University of Korea (since 1980)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 222 Banpo-daero, Seocho-gu, Seoul 137-701, Korea
- **Tel.** 82-2-2258-5745
- **E-mail.** ihcc@caholic.ac.kr
- **Homepage.** <http://www.cmcseoul.or.kr/global/eng/front>
- **Language Service.** English, Russian, Arabic, Japanese

### 16 Severance Hospital, Yonsei University College of Medicine (since 1885)

- **Major treatment.** Pediatric Cardiac Surgery and Cardiology, Cardiac Surgery, Cardiology
- **Address.** 50-1 Yonsei-ro, Seodamun-gu, Seoul 120-752, Korea
- **Tel.** 82-2-2228-5800
- **Homepage.** <http://www.yuhs.or.kr/en/>
- **Language Service.** English, Chinese, Russian, Arabic

\* List in alphabetical order