# CONGENITAL HEART DISEASE

AMERICAN COLLEGE of CARDIOLOGY 75 ANNIVERSARY

## FETAL **CARDIAC IMAGING** AND **INTERVENTIONS**

Since the late 1980s, advancements like like color Doppler, 3D echocardiography, first trimester fetal echocardiography by transvaginal ultrasound, and fetal magnetic resonance imaging have improved prenatal diagnosis of congenital heart disease (CHD). More recently, the 3-vessel view and other new emerging fetal cardiac interventions also have the potential to change the field even further

## **ADVANCED IMAGING** AND **PROCEDURAL PLANNING**

**Late 1990s**
The matrix array probe with parallel processing makes real-time 3DE possible, paving the way for the development of smaller transducers. The introduction of transillumination and color Doppler allow for improved surgical and catheter-based interventional planning

**2000s** 4D Flow MRI is introduced to the clinical environment, significantly shortening imaging

**Today** Comprehensive surgical planning software platforms hold the potential to streamline processes, reduce turnaround times and optimize postoperative hemodynamics

## ADVANCES IN **ARRHYTHMIA MANAGEMENT**

**1980s-1990s**
Pacemakers are adapted to meet the complex anatomy and small size of CHD patients

**2016** Technological improvements, such as catheter cryoablation, 3D mapping, percutaneous epicardial ablation, and high-powered ablation catheters using passive or active tip cooling, change ablation guidance

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## ADVANCES IN **CONGENITAL CARDIAC SURGERY**

**1944** First use of the Blalock-Thomas-Taussig (BTT) shunt to treat cyanotic congenital heart defects

**1958** First bidirectional Glenn procedure is performed. Today, this procedure is the second of three palliative surgeries (following Norwood) for patients with single ventricle heart defects

**1963** The first Mustard procedure to repair transposition of the great arteries (TGA) is performed, joining the Senning procedure which was first performed in 1957

**1968** The first Fontan procedure is performed, rerouting the systemic venous blood flow directly to the lungs, with the ventricle(s) pumping oxygenated blood to the body

**1975** The first successful arterial switch operation on an infant is performed, largely replacing the Mustard and Senning techniques

**1977** First Norwood procedure is performed.. This remains the first of three palliative surgeries for infants with single ventricle heart defects

**Today** Nearly 70% of babies born with critical CHD are expected to survive to 18 years of age

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## **HEART** TRANSPLANT

### 1967

First neonatal heart transplant attempted in a three-week old with tricuspid atresia, proving the technical feasibility of cardiac transplantation in pediatric patients. By 2017 congenital heart disease accounted for 40% of pediatric heart transplants, with increasing post-transplant survival rates

## **PATIENT** AND **CLINICIAN SUPPORT**

The growth and expansion of organizations dedicated to supporting children, families and adults with CHD has led to increased awareness, and improved outcomes

Support for clinicians has also grown. The ACC established the Adult Congenital and Pediatric Cardiology (ACPC) Section in 2004 to address quality, education and advocacy issues

Scan the QR code for quick access to ACC's CardioSmart patient resources

## **TRANSCATHETER VALVE** THERAPIES

### 2000

First human transcatheter pulmonary valve replacement performed using a Melody valve. Since then, newer types of transcatheter pulmonary valves have emerged and are in use today

## **HYBRID** PROCEDURES

### 2007

Collaborations between interventional cardiologists and cardiac surgeons spark innovative hybrid procedures, revolutionizing the treatment of some complex congenital heart defects

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## **GENETIC** AND **GENOMIC** RESEARCH

**1950s** Karyotyping becomes available, allowing researchers to study chromosomal abnormalities in patients with CHD

**1994** Fluorescence in situ hybridization (FISH) is increasingly used to elucidate genetic alterations and chromosomal abnormalities

**Early 2000s** Karyotyping and FISH begin to be replaced by chromosome microarrays (CMAs). Copy number variation (CNV) detection and next-generation sequencing (NGS) gene panels also begin to be widely used genetic counselors and cardiologists for accurate diagnosis of congenital heart disease patients.

**Today** Approximately 400 genes have already been implicated in CHD. Continued identification of specific genes and increased understanding of the etiology of CHD hold promise for improving genetic diagnoses, mitigating risks, and personalizing treatments

## **ARTIFICIAL** INTELLIGENCE

Artificial intelligence (AI) has the potential to enhance cardiac imaging interpretation, refine preprocedural planning and improve outcome prediction. It can also aid in early prenatal detection as well as risk assessment in aging patients

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