

## MODERN CARDIAC SURGERY: EVOLUTIONARY MILESTONES AND CLINICAL RELEVANCE

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**Chorieyva Zulfiya Yusupovna**

*Termez branch of Tashkent State Medical University*

*Department of Anatomy and Clinical Anatomy*

*Doctor of Medical Sciences*

[zulfiyachoriyeva69@gmail.com](mailto:zulfiyachoriyeva69@gmail.com)

**Begalov Mirzohid**

*1st year medical student*

[mirzohidbegalov@gmail.com](mailto:mirzohidbegalov@gmail.com)

### **Abstract**

**Background:** Cardiovascular diseases remain the leading cause of mortality worldwide, necessitating continuous advancements in surgical.

This study aims to analyze the developmental stages of modern cardiac surgery and evaluate the clinical significance of its principal operative techniques. A narrative review approach was employed, examining contemporary surgical practices including coronary artery bypass grafting, valvular heart surgery, correction of congenital defects, and minimally invasive procedures.

Technological innovations, improved cardiopulmonary bypass systems, and refined surgical techniques have significantly enhanced survival rates, reduced perioperative complications, and improved quality of life among patients with cardiovascular diseases.

Modern cardiac surgery plays a decisive role in the treatment of complex cardiac pathologies. Ongoing innovation and minimally invasive approaches are shaping the future of cardiac surgical care.

### **Keywords**

cardiac surgery, coronary artery bypass grafting, valvular heart disease, congenital heart defects, minimally invasive surgery, cardiovascular diseases

### **Introduction**

Cardiovascular diseases account for the highest global mortality rates and represent a major public health burden. Cardiac surgery has evolved as a specialized medical discipline dedicated to the operative treatment of structural and ischemic heart conditions. Over the past century, technological advancements

and improvements in perioperative care have dramatically transformed surgical outcomes.

### **Materials and Methods**

This study is based on a comprehensive review of contemporary scientific literature, surgical textbooks, and recent clinical findings in cardiac surgery. The analysis focuses on four principal domains: coronary artery bypass grafting (CABG), surgical treatment of valvular heart disease, correction of congenital heart anomalies, and minimally invasive cardiac techniques.

### **Results**

#### **Coronary Artery Bypass Grafting**

Coronary artery disease results from progressive atherosclerotic narrowing of coronary vessels, leading to myocardial ischemia. CABG restores myocardial perfusion by creating alternative conduits for blood flow using autologous grafts. The procedure significantly reduces mortality in patients with multivessel disease and left main coronary artery involvement.

#### **Surgical Management of Valvular Heart Disease**

Valvular disorders such as stenosis and regurgitation impair cardiac hemodynamics and may lead to heart failure if untreated. Surgical options include valve repair or replacement with mechanical or bioprosthetic prostheses. Advances in imaging and prosthetic design have improved long-term durability and patient outcomes.

#### **Correction of Congenital Heart Defects**

Congenital cardiac anomalies vary in severity from minor septal defects to complex structural malformations. Early detection through echocardiography and timely surgical intervention enable favorable long-term prognosis. Pediatric cardiac surgery has achieved substantial improvements in survival and postoperative recovery.

#### **Minimally Invasive Cardiac Surgery**

Minimally invasive approaches utilize small thoracic incisions, endoscopic assistance, and robotic technologies. These techniques reduce surgical trauma, shorten hospitalization, and accelerate rehabilitation while maintaining procedural effectiveness comparable to conventional open-heart surgery.

### **Discussion**

The evolution of cardiac surgery reflects the integration of biomedical engineering, advanced imaging, and refined operative techniques. Although percutaneous interventions have expanded therapeutic options, surgical treatment remains indispensable for complex coronary, valvular, and congenital conditions.

Future directions include robotic-assisted surgery, hybrid procedures, and personalized surgical planning based on patient-specific risk stratification.

### **Conclusion**

Modern cardiac surgery constitutes a cornerstone in the management of cardiovascular diseases. Continuous innovation, minimally invasive techniques, and multidisciplinary collaboration are expected to further enhance survival rates and improve quality of life for patients worldwide.

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