Summary

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As the need for mechanical circulatory assistance i increasing, advances and development in its structure, function, and cor rol continue to influence the outcome and the patient benefit. Howeve the devices available today are the result of long and hard wo by many investigators, researchers, and clinicians.

Despite substantial improvement in myocardial p tection and other technical advances, postoperative ventricular dysfunct n persists as a complication in 2-6% of all patients undergoing cardia or thoracic aortic sugary. Despite maximal inotropic therapy, 0.5- % of these patients can not be weaned readily from CPB and would equire some form of mechanical cardiac assistance to achieve adeq ate systemic pressure and perfusion.

The currently available circulatory assist devices ar the artificial cardiac pacemaker, the intraaortic balloon pump, the ver ricular assist devices, and the implantable cardioverter defibrillat r. Different haemodynamic and physiopathologic changes occur with th use of these mechanical circulatory assist devices and understanding of hese changes is very important to help the surgeon, anesthetist, and p fusionists to decrease the morbidity of these changes on the patient.

A) Artificial cardiac pacemaker:

Electronic cardiac pacemakers are temporary r permanent (implanted) devices that electrically stimulate the heart.

Pacemakers consist of a power source (battery) t at supplies energy for stimulation and other pacemaker functions, circuit for sensing and regulation of stimulation, and leads that connect the p ower source and electronic circuitry to electrodes.

Artificial pacing is indicated for treatment of pers stent brady-cardia of any origin if it compromises hemodyramics or p edisposes to ventricular irritability manifested by premature beats o ventricular tachycardia (VT). The two major indications for permane t pacing are failure of impulse formation and failure of cardiac conductic n. Clinically, sick sinus syndrome and complete heart block are the m ost common indications for pacemakers.

Complications following pacemaker or PCD impl ntation:

Early	Late	Ea y or late
Pneumo (hemo)-thorax subcutaneous emphysema myocardial perforation arterial lead placement brachial plexus injury	Thromboembolism, pulse generator erosion, lead defects ↑ pacing thresholds battery depletion	Lead disl lgement pacemake arrhythmias pacemake infection pacemake syndrome generator alfunction extracardi c stimulation

B) The intraaortic ballon pump:

The IABP is a catheter mounted intravascular devic s designed to improve the balance between myocardial oxygen supply and demand while increasing systemic perfusion to a modest d egree. Other components of IABP include a pump, a gas source, and a m icroprocessor console.

The primary indications for IABP in cardiac surgi al patient are inability to separate from CPB, poor haemodynamic unction, and ongoing ischaemia following CPB despite increasing drug support.

Myocardial function often improves with the use of the IABP, and systemic perfusion and vital organ function are preserved. I is crucial to control heart rate and suppress atrial and ventricular dys hythmias to ensure proper balloon timing. As cardiac function returns, tl e assist ratio is gradually weaned from every beat to every other bea and so on assuming no further cardiac deterioration, then removed.

Complications associated with the IAP are primar y related to ischaemia distal to the site of balloon insertion. Direct t auma to the vessel, arterial obstruction, and thrombosis are the m st common complications, although aortic perforation and balloon r upture occur rarely. Platelet destruction and thrombocytopenia may also o ccur.

C) Automatic implantable

Cardioverter defibrillator

Recurrent ventricular tachycardia or ventricular fibril tion that can result in sudden death in the survivor of cardiac arrest may b treated with an automatic implantable cardioverter defibrillator (AICD) t hat senses the onset of these ventricular dysrhythmias and delivers a syn hronized 25-joule electrical discharge.

Table (11) Potential complications of ICD surger

I) Complications resulting from the subclavian stick technique	II) Surgical complications related to the pulse generator	III) Surgi l complications related t the ICD leads
Pneumothorax Hemothorax Subclavian artery puncture Air embolism Bleeding Hemoptysis Brachial plexus injury Subclavian artriovenous fistula	Pocket erosion Pocket hematoma Pocket seroma Pocket infection	Lead dislodg ment Lead perofra on Loose set sc w Failure to is ate the set screw Microdisloc ion Malposition Diaphragma stimulation Exit block Conductor f cture Insulation b ak Venous thro bosis Pulmonary e bolism

Contraindications:

Implantation of an ICD is contraindicated in any patie it who has a remedial cause of ventricular arrhythmias such as acut myocardial infarction, myocardial ischemia, electrolyte imbalance, d ug toxicity, hypoxia, or sepsis.

D) The ventricular assist device:

The VAD is a blood pump that is designed to assist · replace the function of either the right or left ventricle. In the absence c right or left ventricular ejection, the RVAD supports the pulmonary circ lation, while a LVAD provides systemic perfusion respectively. Implanta le VADs are positioned intracorporeally in the anterior abdominal wal or within a body cavity other than the pericardium.

Extracorporeal VADs may be located in a paracorp eal position, along the patient's anterior abdominal wall, or externally, a the patient's bedside.

Infrequently, the heart is unable to meet systen c metabolic demands despite maximal pharmacologic therapy and in: ertion of the IABP. Under these circumstances, devices that actually pu ıp blood and bypass either the left or right ventricle are required. Thes : devices are effective because the injury producing myocardial dysf nction takes place intraoperatively and, more important, is often reversi le. A second group of patients who have shown benefit from assist dev ces are those with chronic heart failure. These devices allow for h emodynamic support as a temporary measure prior to heart transplantatic ı.

Complications of VADs are inadequate LVAI flow, right ventricular failure, haemorrhage, thromboembolism, infectio , multisystem organ failure, device malfunction, and pump dependency.