Myocardial protection

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Once CPB has been established, the ascending aorta is usually cross-clamped to obtain a bloodless operative field. The heart ceases ejecting and becomes anoxic owing to inhibition of coro - nary blood flow . Permanent myocardial damage can develop within 15–20 minutes, therefore most cardiac operations require some form of myocardial protection. Tec hniques of myocardial protection and the operative management of the myocardium have had a significant impact on the complexity of cardiac surgery . Methods of myocardial protection include intracoronary infusion of a cardioplegic solution (antegrade), infusion via the coronary sinus (retrograde), intermittent cross-clamp fibrillation and total circulatory arrest. Cardioplegia solutions vary in temperature, pH, osmolality and the presence of red cells. Potassium is the most commonly used arresting agent, stopping the heart in diastole by (4–10°C) isotonic crystalloid or blood solutions aid myocardial protection by reducing metabolic requirements through local hypothermia. Warm cardioplegic solutions, on the other hand, may facilitate better myocardial recovery postoperatively by aiding activation of intramyocardial enzymes. Cardioplegia solutions will need to be given repeatedly every 15–20 minutes during surgery . Other cardioplegia solutions that can be given as a single dose are usually reserved for more complex and longer operations. Intermittent cross-clamp fibrillation is a technique in which intermittent ventricular fibrillation (VF) is induced by a small electrical charge. The heart does not eject and is relatively still but not bloodless . The aorta is cross-clamped to render the heart ischaemic. The heart can tolerate short periods (10–20 minutes) of ischaemia, providing it is reperfused when the cross-clamp is released and allowed to beat following cardio version for short periods. Total circulatory arrest is necessary when visibility and clar ity of the operative field is crucial, as in paediatric surgery or in surgery of the ascending arch of the aorta. CPB is established and the core body temperature reduced to 15–18°C (pro found h ypothermia). The metabolic rate of all body organs is reduced by 50% with every 7°C drop in temperature. Using this technique, circulatory arrest (in w hich the CPB machine is switched o ff) can be tolerated for up to 20–30 minutes. Additional cerebral protection can be provided with ice packs placed around the head, pharmacological agents such as thio pental or steroids and cerebral perfusion techniques that allow for longer arrest times. Discontinuing cardiopulmonary bypass At the end of the procedure, air must be meticulously excluded from the cardiac chambers (de-airing). Once perfusion is restored to the coronary arteries (by removing the cross-clamp) the heart may beat spontaneously . If VF is present, cardio version may be required. Epicardial pacing wires are usually placed to treat postoperative bradycardia or heart block. T patient is rewarmed, acidosis and hypokalaemia are corrected and ventilation is restarted. The heart gradually takes over the circulation while the arterial flow from the CPB machine is reduced (‘weaning from bypass’). When the blood pressure is acceptable and the surgeon is confident that the heart func tion is adequate, CPB is discontinued and anticoagulation is reversed by administering protamine and the cannulae are removed.

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