

## Organ protection with intravenous agents

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Myocardial protection by pre-conditioning involves increasing the tolerance to ischaemia-reperfusion injury and can be achieved by either mechanical or pharmacological means. Pre-conditioning involves the therapeutic manoeuvre being applied before the start of ischaemia while post-conditioning applies the manoeuvre after the start of ischaemia.

The initial method for achieving myocardial protection by pre-conditioning was to subject the heart to brief ischaemic episodes by occluding the coronary arteries. This was interspersed with reperfusion before prolonged ischaemia was begun. Benefits of this technique included decreases in infarct size, reduced post-ischaemic myocardial dysfunction and decreased frequency of arrhythmias.

### PRE-CONDITIONING WITH ANAESTHETIC AGENTS

Similar but more controllable effects can be produced with drugs such as anaesthetic agents and opioids. These represent a safer approach compared with mechanical occlusion of coronary arteries. Animal studies showed the benefit of several agents for pre-conditioning. While this may improve clinical outcome, it has been difficult to confirm the benefit in well-designed, large-scale, randomized, controlled clinical trials.

### PRE-CONDITIONING WITH OPIOIDS

Myocardial pre-conditioning can be produced with opioids but relatively high doses may be required which may cause delayed recovery and increased adverse effects. The introduction of remifentanyl allowed relatively high doses to be

given without prolonged effects. Animal studies have shown potential clinical benefit from myocardial pre-conditioning, and a clinical study has demonstrated that the addition of remifentanyl to the anaesthesia regimen reduced the degree of myocardial damage.

### CARDIOPROTECTION WITH PROPOFOL

Propofol has been shown in a number of animal studies to protect against ischaemia-reperfusion injury for several organs, including the heart. A study of more than 10,000 cardiac bypass procedures showed that while sevoflurane appeared to be superior to propofol in patients with little or no ischaemic heart disease, mortality in acute procedures was significantly lower in the propofol group. In addition, mortality caused by infection, pulmonary or renal causes was significantly lower in the propofol group. This was probably caused by an anti-oxidant effect. In a recent comparison during cardiac bypass surgery, the maximal postoperative troponin-T values, which were used as markers of myocardial damage, did not differ significantly between patients who received total intravenous anaesthesia, sevoflurane or desflurane.

### CONCLUSIONS

Opioids mediate myocardial pre-conditioning and also post-conditioning and may be as effective as volatile agents for this purpose. Propofol is a recognised free-radical scavenger with widespread beneficial effects on different organ systems. It may offer additional protection especially in patients with severe ischaemic heart disease or with concomitant multi-organ disease.

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