

# **Preconditioning and coronary intervention**

## **definition**

- Ischemic preconditioning (IPC) describes the phenomenon whereby transient, brief periods of ischemia confer protection against a subsequent prolonged and injurious period of ischemia.

## history

- Ischemic preconditioning was first described in 1986, when Murry et al. demonstrated that in the dog, brief episodes of ischemia (4 cycles of 5-minute occlusion followed by reperfusion) of the circumflex artery reduced the extent of infarction induced by subsequent prolonged occlusion of that vessel [1].

## Phases of IPC

- Early phase starts after the procedure and lasts only few hours
- Late phase that's recovered after 24hours. this second phase of protection lasts for up to a further 72 hours [2-4].

## Types or methods

- Local IPC. when the preconditioning stimulus is applied to the same organ or tissue that will subsequently sustain the ischemic injury.
- Remote IPC. refers to a stimulus applied to a distant organ or tissue, which then protects against index ischemia. For example, the preconditioning stimulus might be suprasystolic blood pressure inflations on an arm or leg, which then confer myocardial protection against subsequent ischemia.

## MECHANISM

- this phenomenon may be a form of receptor-mediated cardiac protection and that the underlying intracellular signal transduction pathways involve activation of a number of protein kinases, including protein kinase C, and mitochondrial  $K_{ATP}$  channels.

## Reperfusion injury salvage kinase (RISK)

- Reperfusion injury salvage kinase (RISK) pathway describes a group of survival protein kinases, *which include Akt and Erk1/2* that confer powerful cardio-protection against lethal reperfusion injury when specifically activated at the time of reperfusion (Hausenloy and Yellon 2007). The cardio-protective effect of ischemic preconditioning is completely aborted by inhibiting RISK pathway (Hausenloy et al 2005).

## Remote Ischemic Preconditioning RIPC

## definition

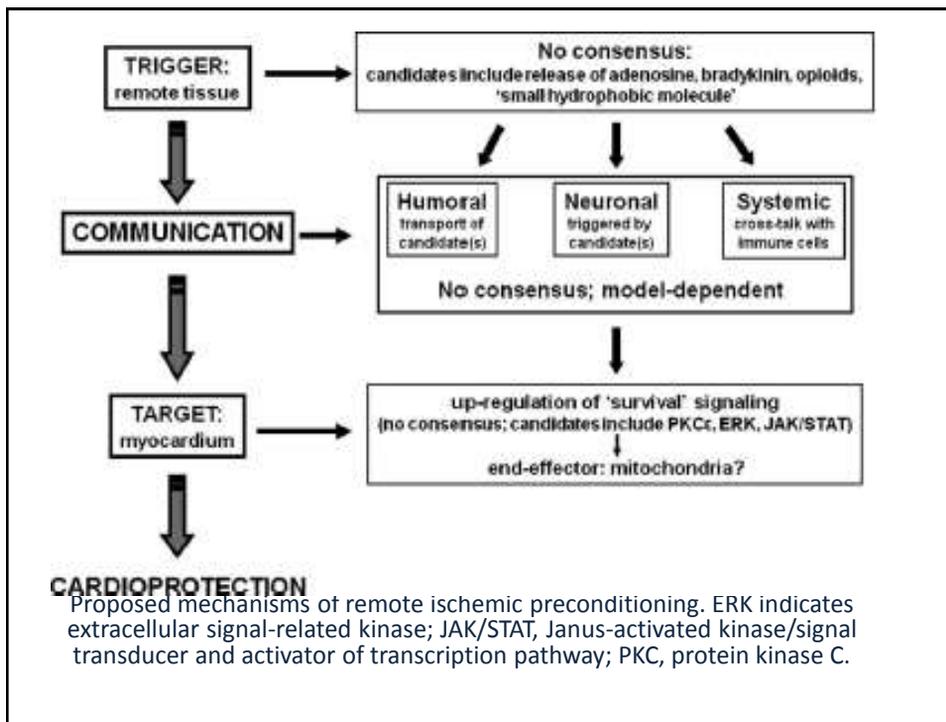
- Remote ischemic preconditioning (RIPC) is the phenomenon whereby brief episodes of ischemia–reperfusion applied in distant tissues or organs render the myocardium resistant to a subsequent sustained episode of ischemia.

### Remote Ischemic Preconditioning or Ischemic Conditioning at a Distance

Ischemic conditioning of one vascular bed may protect a remote vascular bed. This could occur within the same organ or between different organs.

## Mechanistic Insights

- There are 3 inherent mechanistic components of RIPC-induced cardioprotection:
  - 1- the trigger/triggers activated or generated in the remote tissue.
  - 2- the requisite communication between the remote site and the heart.
  - 3- induction of the protective phenotype in the myocardium (Figure 2).



- Evidence for involvement of a humoral factor in mediating systemic spread is supported by the observation that protection can be transferred by the transfusion of serum from a rabbit that has undergone ischemic preconditioning to one which has not [17, 18]. In some studies it is blocked by opioid antagonists, including naloxone [21, 22].

- Neurogenic mechanisms have also been explored using autonomic ganglionic blockade. In a rat myocardial infarction model hexamethonium abolished protection by RIPC achieved by mesenteric artery occlusion (MAO) but had no effect on myocardial IPC. Cardioprotection was absent when MAO was sustained throughout the study, indicating that reperfusion in the small intestine was essential to activate the neurogenic pathway [6].

- The autonomic ganglion blocker trimethopphan has also been shown to inhibit remote ischemic preconditioning in a human model [23].

**Different methods of Remote Ischemic Preconditioning and its Effect on Outcome of Elective Percutaneous Coronary Intervention**

## ***Objectives:***

The purpose of the study was to assess and compare different methods of remote ischemic preconditioning to reduce cardiac myonecrosis as measured by quantitative cardiac troponin I after elective percutaneous coronary intervention and to reduce major adverse cardiac event rate at 6 months follow up.

## ***Methods:***

- This study was conducted on 120 symptomatic patients with coronary heart disease and scheduled for elective percutaneous coronary intervention.

- Group I included 40 patients who underwent remote Ischemic Preconditioning immediately before PCI through the upper arm.
- group II included 40 patients who underwent remote Ischemic Preconditioning immediately before PCI through the upper thigh.
- group III (the control group) included 40 patients with no Remote Ischemic Preconditioning.

## Results

- Results of the study showed that both ST segment deviation during intervention, and the rise in cTnI was significantly lower (p-value <0.05) in patients who underwent remote preconditioning via leg & arm groups vs. Control groups.

- There was no significant difference between groups as regard incidence of MACE at 6 months follow up.

### ***Conclusion***

- RIPC increases the tolerance of the myocardium to ischemia, reduces ischemic chest discomfort during coronary balloon occlusion, reduces ST segment deviation during intervention, reduces the rise of cTnI release after elective PCI

- RIPC using the upper or lower limb has protective effects on the myocardium.

Thank you