



ISCHEMIA

REPERFUSION

INJURY

ISCHEMIA REPERFUSION INJURY



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WHY PATHOLOGY?

CATEGORIES

Select Category

ILOVEPATHOLOGY



ISCHEMIA – REPERFUSION INJURY

Ischemia

Reduced blood supply

Reperfusion

Restoration of blood
flow



Recovery of
cells

*Which have
reversible injury*

PARADOX



Exacerbate cell
injury



Death of cells!

Reverse of the
expected outcome

ISCHEMIA- REPERFUSION INJURY

Death of cells which would have otherwise RECOVERED!

ISCHEMIA – REPERFUSION INJURY

SIGNIFICANCE

contributes to tissue damage during myocardial and cerebral infarction

Following therapies to restore blood flow

ISCHEMIA – REPERFUSION INJURY- SCENARIOS

**When the
ischemia is
sudden!**

Myocardial infarction

Stroke

Acute limb ischemia

Embolism or thrombosis

Gastrointestinal

Mesenteric artery blockage

Trauma or crush
injuries

**When the
ischemia is
anticipated!**

Cardiac surgery

Organ transplantations

Peripheral vascular
surgeries

Elective surgeries

Orthopedic- use of tourniquets

How does reperfusion injury occur?

New damaging processes

Contributes to tissue damage during myocardial and cerebral infarction

Following therapies to restore blood flow

**OXIDATIVE
STRESS**



**INTRACELLULAR
CALCIUM**

INFLAMMATION

**COMPLEMENT
SYSTEM
ACTIVATION**

How does reperfusion injury occur?

**OXIDATIVE
STRESS**



**INTRACELLULAR
CALCIUM**

INFLAMMATION

**COMPLEMENT
SYSTEM
ACTIVATION**

How does reperfusion injury occur?

OXIDATIVE STRESS

Reperfusion
↓
Increased oxygen through **DAMAGED** endothelial cells, parenchymal cells and leukocytes

↑ INTRACELLULAR CALCIUM

INFLAMMATION

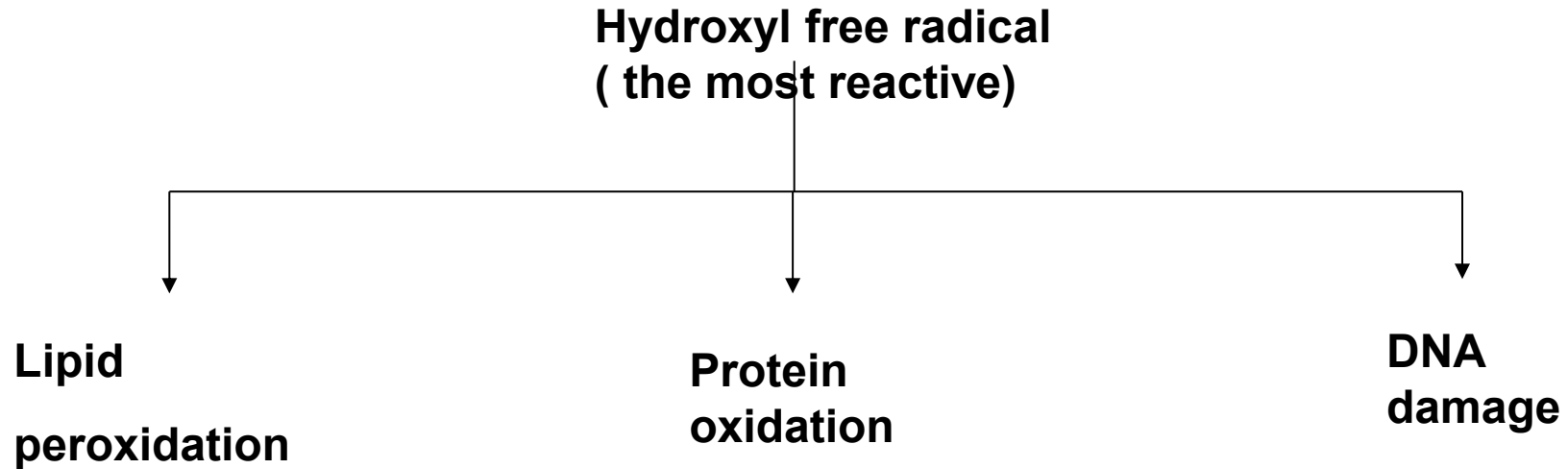
COMPLEMENT SYSTEM ACTIVATION

DAMAGED mitochondria
↓
Incomplete reduction of O₂
↓
↑ Generation of free radicals

Ischemia
↓

↓ Anti-oxidant mechanism

Mechanism of injury



Superoxide radical:

Stimulates the production of enzymes by leukocytes which helps in degradation

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Cell death

How does reperfusion injury occur?

OXIDATIVE
STRESS

 **INTRACELLULAR
CALCIUM**

INFLAMMATION

COMPLEMENT
SYSTEM
ACTIVATION

Ischemia



Calcium
overload
begins

Reperfusion



Increased free
radicals

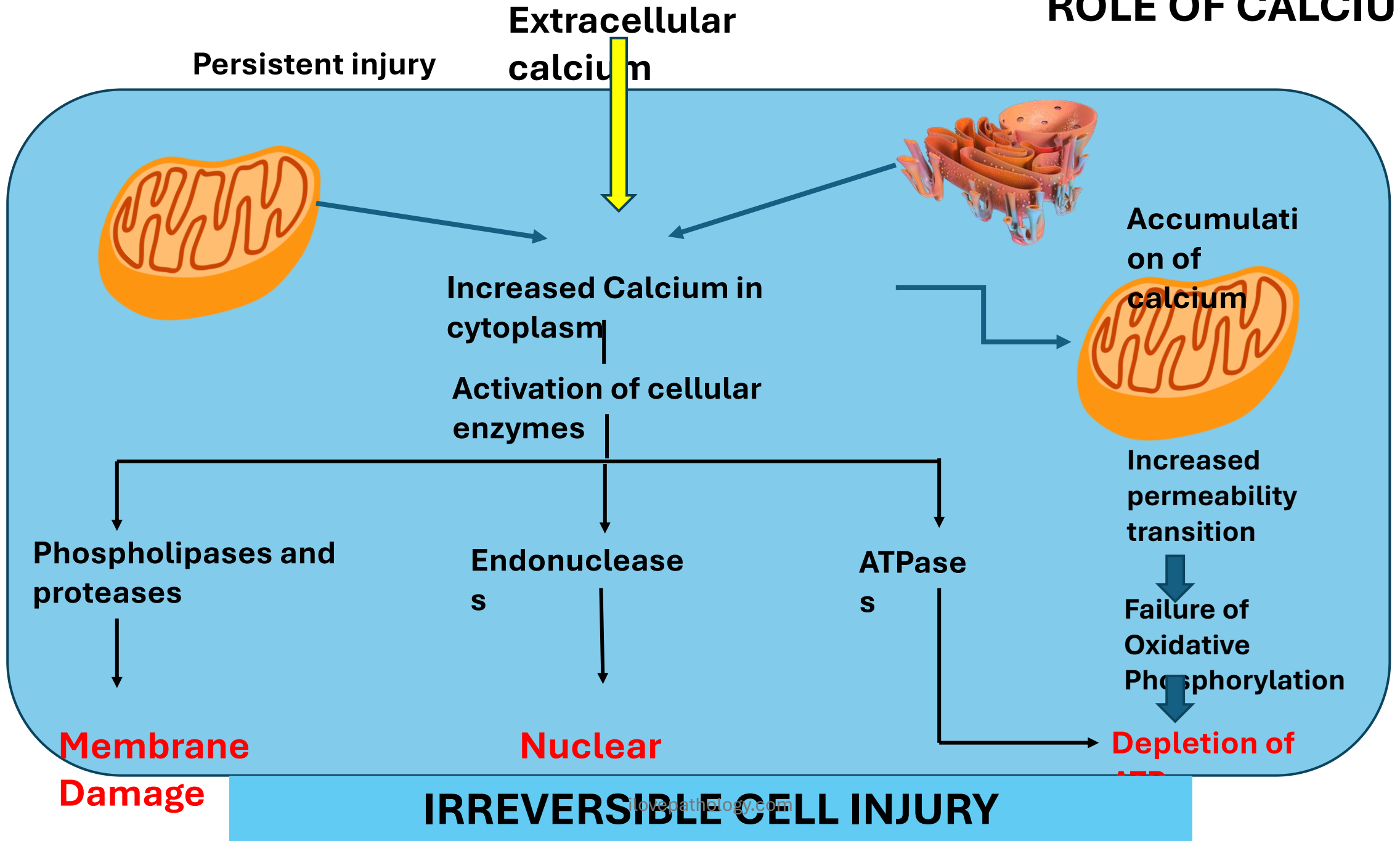


Damage to cell membrane
& ion channels



More intracellular
calcium!

ROLE OF CALCIUM



How does reperfusion injury occur?

OXIDATIVE
STRESS

↑ INTRACELLULAR
CALCIUM

INFLAMMATION

COMPLEMENT
SYSTEM
ACTIVATION

During
reperfusion

P-selectin to
the cell
surface

Cellular
adhesion
receptors are
activated
Increases neutrophil
binding to
intercellular
adhesion molecule-1
(ICAM-1)

Migration of
neutrophils through
the wall to the tissue

release cytotoxic
mediators
*(TNF), interleukins (ILs),
and NOS*

Production of
free radicals!
promote
vasoconstriction,

How does reperfusion injury occur?

OXIDATIVE
STRESS



INTRACELLULAR
CALCIUM

INFLAMMATION

**COMPLEMENT
SYSTEM
ACTIVATION**

IgM antibodies
deposit in
ischemic
tissues
Cause unknown

During
reperfusion

Complement
binds to these
antibodies

Activation of
complements

Exacerbate cell injury
and inflammation

ISCHEMIA – REPERFUSION INJURY

SIGNIFICANCE

contributes to tissue damage during myocardial and cerebral infarction

Following therapies to restore blood flow

Can expect clinical manifestations and thereby plan strategies to prevent injury

CLINICAL FEATURES

DEPENDS ON

Type of the tissue affected

The duration of inschemia

Ability to reperfuse

CLINICAL FEATURES

Myocardium

Myocardial
'stunning'

Cardiac arrhythmias
Sudden death

Renal

CKD

Hypertension

Neutrophil invasion
and damage

Gastrointestinal

Pain

GI Bleed

Can IRI be prevented?

DEPENDS ON

Sudden or anticipated ischemia

Preconditioning

Exposing the tissue to short periods of ischemia before the prolonged ischemic event

Postconditioning

intermittent interruptions of blood flow early in the reperfusion phase.

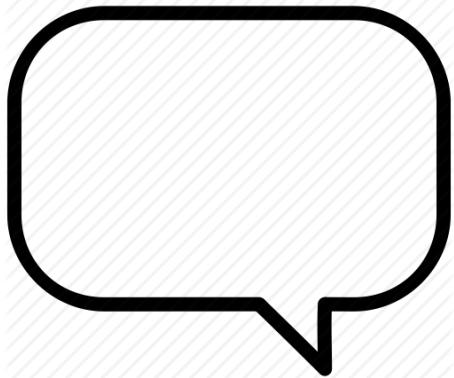
Therapy

Anti-oxidants, anti-inflammatory, calcium channel blockers etc

Hypothermia



THANKS FOR WATCHING



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