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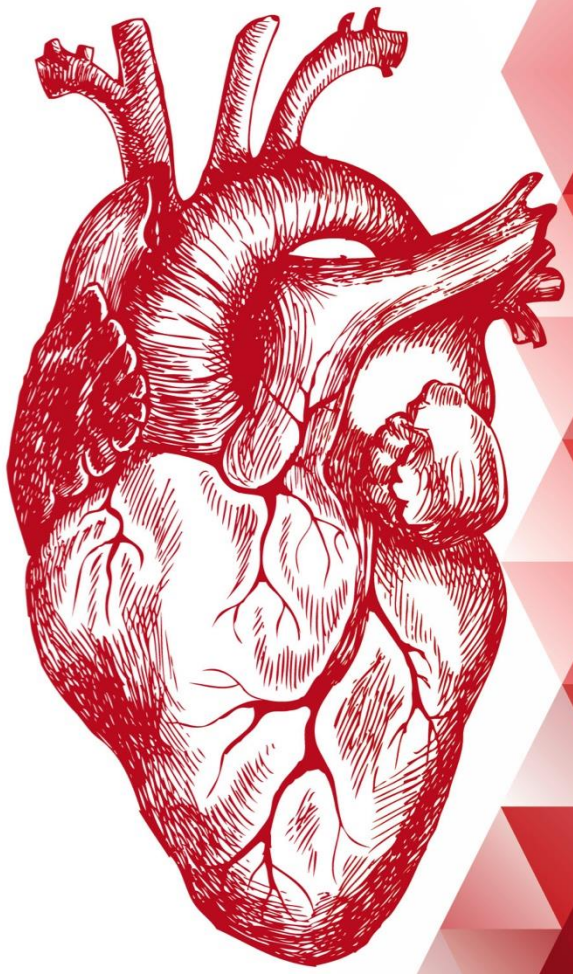
PCI AT A GLANCE



TREATING PATIENTS WITH THE END OBJECTIVE IN MIND

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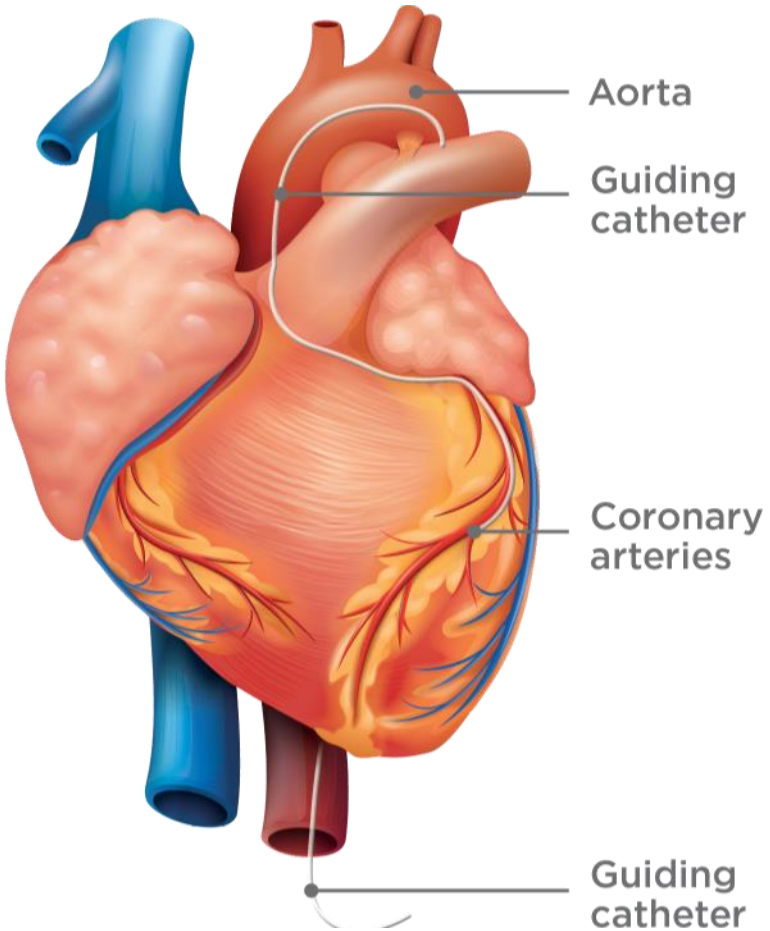
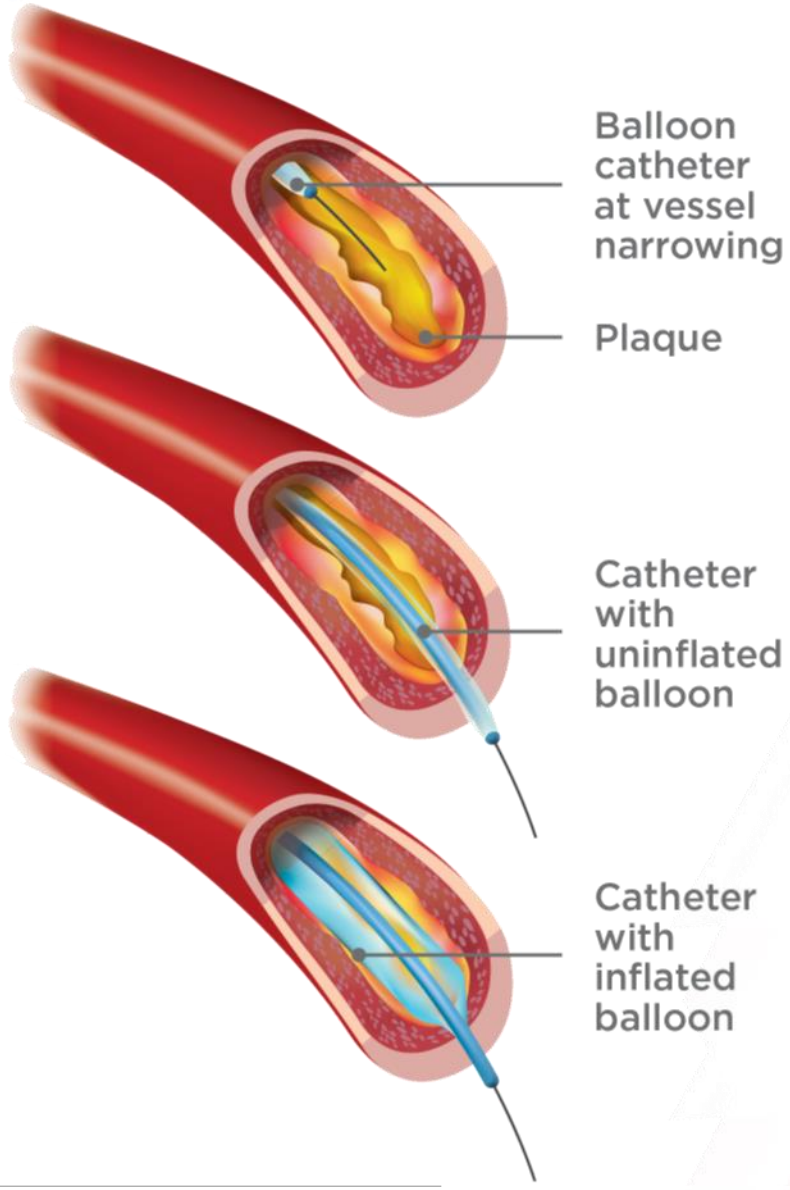
PCI*





*Percutaneous Coronary Intervention

1. Levine G.N, Bates E.R, Bakenship J.C et al. 2015 ACC/AHA/SCAI Focused update on Primary PCI. Journal of the American College of Cardiology. 2016; 67(10): 1235-50
2. Charles Patrick Davis, P. (2019). What Is Percutaneous Coronary Intervention (PCI)?. [online] eMedicineHealth. Available at: https://www.emedicinehealth.com/percutaneous_coronary_intervention_pci/article_em.htm#what_is_percutaneous_coronary_intervention_pci [Accessed 4 Jan. 2019].

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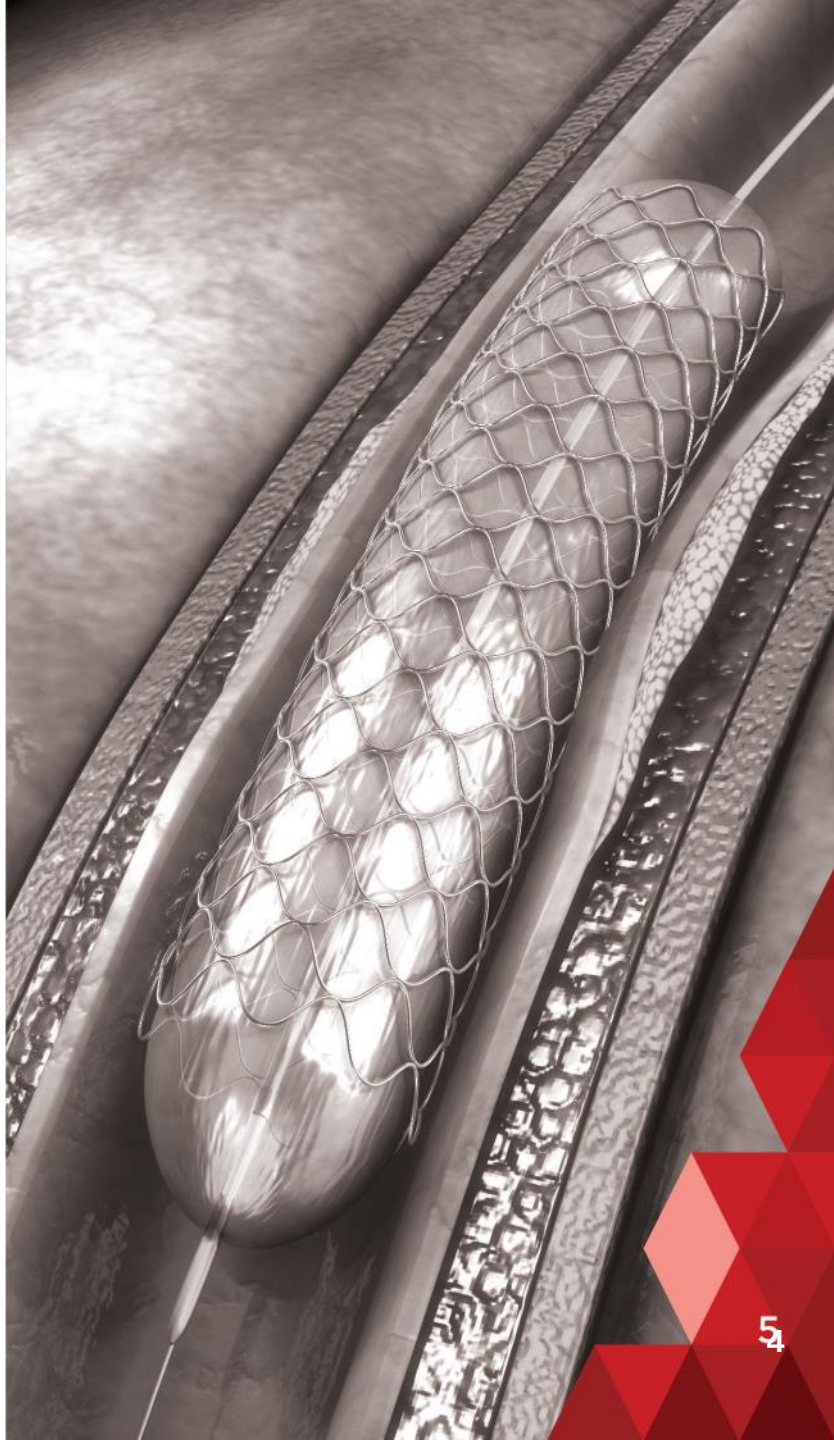
WHAT IS PCI

- **NON-SURGICAL** intervention[1]
- Also known as **CORONARY ANGIOPLASTY**[1]
- Method of **REVASCULARIZATION**[2]
  - **BALLOON AT END OF CATHETER** inserted to open stenotic (narrowed) coronary vessels[1]
- Sometimes a **STENT** is placed in the artery to keep it permanently open



1. Heart and Stroke Foundation of Canada. (2019). Percutaneous coronary intervention. [online] Available at: https://www.heartandstroke.ca/heart/treatments/surgery-and-other-procedures/percutaneous-coronary-intervention [Accessed 4 Jan. 2019]. Levine G.N, Bates E.R, Bakenship J.C et al. 2015 ACC/AHA/SCAI Focused update on Primary PCI. Journal of the American College of Cardiology. 2016; 67(10): 1235-50
2. En.wikipedia.org. (2019). Revascularization. [online] Available at: https://en.wikipedia.org/wiki/Revascularization [Accessed 4 Jan. 2019].

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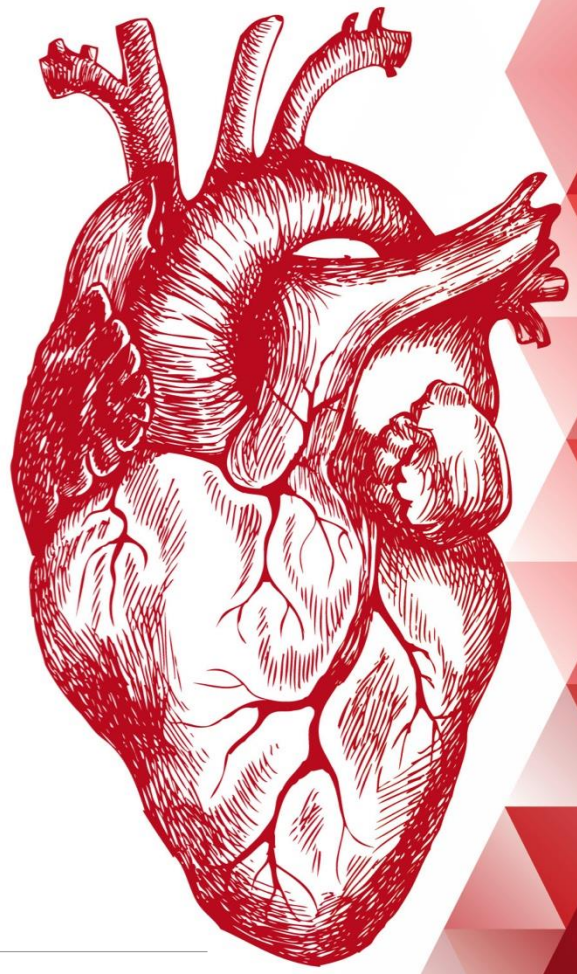
WHAT IS PPCI?*

- PPCI is **CORONARY ANGIOPLASTY** with or without stent(s) or other devices[1]
- **MECHANICAL TECHNIQUE UNDER X RAY** guidance that requires specialised skills and team-members[1]
- More effective in **REOPENING OCCLUDED ARTERIES** than thrombolysis[2]
- For both AHA[3] and ESC Primary PCI[4] is a class 1 A indication for Acute STEMI if it can be performed within **120min OF FIRST MEDICAL CONTACT** (90 minutes if presenting early with a large infarct and low risk of bleeding complications)



*Primary Percutaneous Coronary Intervention

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1. En.wikipedia.org. (2019). Percutaneous coronary intervention. [online] Available at: https://en.wikipedia.org/wiki/Percutaneous_coronary_intervention [Accessed 4 Jan. 2019].
2. Fazel R, Krumholz H, Bates E, French W, Frederick P, Nallamothu B. Choice of Reperfusion Strategy at Hospitals With Primary Percutaneous Coronary Intervention. Circulation. 2009;120(24):2455-2461.
3. O'Gara P, Kushner F, Ascheim D, Casey D, Chung M, de Lemos J et al. 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction. Circulation. 2013;127(4).
4. Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

IMPORTANT FEATURES OF A PPCI NETWORK

- 24/7 **REGIONAL SERVICE**
- Field **DIAGNOSIS+/-TELEMETRY**
- Direct transfer to **CATH LAB;** team ready within **30-60 MINUTES**
- Overall FMC to balloon time of **120 MINUTES**
- **EARLY DISCHARGE** or secure transfer back to local hospital
- Follow-up program with **REHABILITATION**
- **DATA/INFORMATICS STRATEGY** and regular feedback available
- **EDUCATION STRATEGY**

Huber K, Gersh B, Goldstein P, Granger C, Armstrong P. The organization, function, and outcomes of ST-elevation myocardial infarction networks worldwide: current state, unmet needs and future directions. European Heart Journal. 2014;35(23):1526-1532.

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A PATIENT WITH THE FOLLOWING CRITERIA IS SUITABLE FOR DIRECT TRANSFER TO A PPCI CATHLAB

- History of symptoms **COMPATIBLE WITH MI** (<12hrs)
- Clear ST segment elevation in **2 CONSECUTIVE LEADS** (2 small squares anterior, 1 small square non anterior)
- **LBBB** (either new or presumed new)
- **ALERT, ORIENTATED** and **CONSCIOUS**

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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PATIENTS WHO SHOULD NOT BE TAKEN TO A PPCI CATHLAB DIRECT EVEN IF THE ECG SHOWS CLEAR ST ELEVATION

- Patient with a dense **HEMIPLEGIA** suggesting a stroke
- ECG showing **PACED RHYTHM**
- **ACUTE TRAUMA** or **HEMORRHAGE**
- Patient in **CARDIAC ARREST ON SCENE**

These patients should be taken to the ER, regional trauma unit or stroke unit as appropriate

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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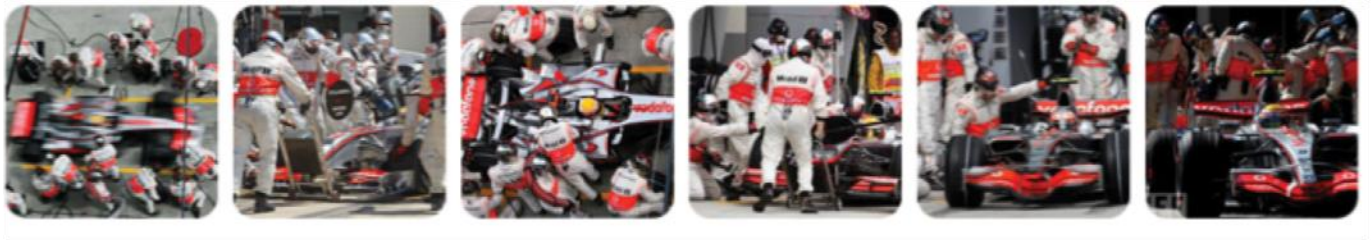
CATHLAB: IMPORTANCE OF HIGH VOLUME



… IS LIKE WELL FUNCTIONING FORMULA 1 TEAM AT THE PIT STOP…

High volume (>400 PCI/year)		**Low volume** (<400 PCI/year)	
Mortality	**6.75%**	Mortality	**8.54%**

Spaulding C, Morice M, Lancelin B, El Haddad S, Lepage E, Bataille S et al. Is the volume-outcome relation still an issue in the era of PCI with systematic stenting? Results of the greater Paris area PCI registry. European Heart Journal. 2006;27(9):1054-1060.

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PRIMARY PCI & TIMELINES

- The **120 MINUTE** timeline represents the **MAXIMAL DELAY** that is considered acceptable rather than the ideal time frame
- Even this timeline is arbitrary, as **PCI-RELATED DELAYS** that mitigate the benefit of mechanical reperfusion vary
  - in a young patient (<65 years) with an anterior infarct presenting within 2 hours, the point of equipoise is 40 min

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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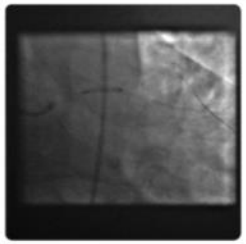
PREFERRED REPERFUSION STRATEGY: PPCI

- Definitive **diagnosis of STEMI** is made using the **angiogram**.
- In **emergency situations** this can be completed in **<10 minutes.**



- The **pPCI treatment** involves **balloon inflation or thrombus catheter aspiration** to open the vessel.
- In most cases a metal scaffold or stent is implanted to keep the vessel open.

- **The aim of pPCI** is to **reopen the previously blocked artery and reestablish anterograde coronary blood flow** in the infarct related artery.

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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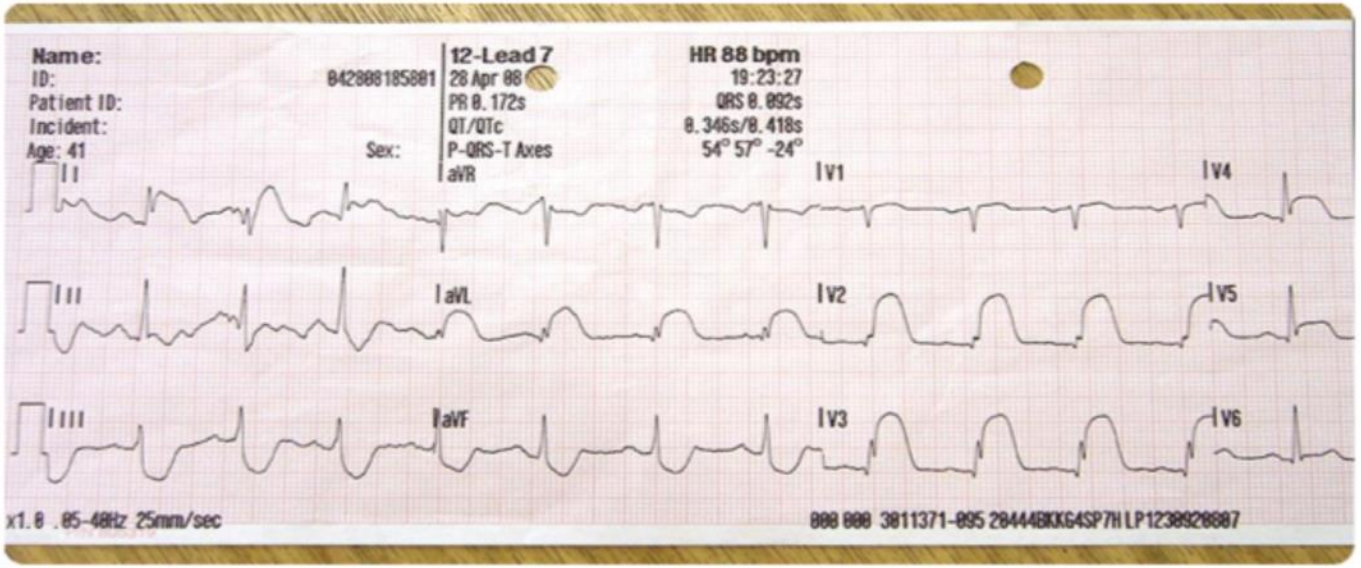
ACTIVATE THE PPCI PATHWAY IMMEDIATELY THE DIAGNOSIS IS MADE

ACUTE ANTEROLATERAL STEMI



Client to provide Source of Picture

Add letter from Dr A Snyders as reference

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BENEFITS OF PPCI VS THROMBOLYSIS

- Lower **in-HOSPITAL MORTALITY**
- Less **COMPLICATIONS**
- Fewer **AMBULANCE JOURNEYS**
- Reduced **UNSCHEDULED REVASCULARISATION**
- **SHORTER LENGTH** of stay
- More **COST-EFFECTIVE** for the healthcare economy

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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DIFFERENCE: THROMBOLYSIS AND PPCI BASED STRATEGIES

LYTIC STRATEGY	PPCI STRATEGY
Diagnosis based on ECG	Diagnosis based on coronary angiogram
2/3 eligible	No absolute contraindications
Not effective in shock	Reduces mortality by half in shock
Of those eligible 50% reach TIMI 3 flow	95% achieve TIMI 3 flow
Ischaemia and reinfarction common	Further ischaemia and reinfarction uncommon
Stroke is an important complication	Stroke very rare
Cheaper start-up costs	Cost effective in the long-term
Easier to organize a service	Harder to organize a service
Needs support of a rescue pPCI service	No rescue pPCI service needed
Longer hospital stay for patients	Shorter hospital stay for patients
Definitive care delivered by generalists	Definitive care delivered by specialists

Courtesy of Prof Rothman and Dr De Palma

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PRIMARY PCI

ADVANTAGES

- Suitable for **70-90%** of patients
- Establishes **grade 3 blood flow in 90 -95%**
- Nearly **eliminates** the risk of intracranial hemorrhage
- Preferred for high-risk patients
  - **cardiogenic shock**
  - **hemodynamic or electrical instability**
  - **severe heart failure**

DISADVANTAGES

- **ACCESS**
  - Resources
    - Human
    - Physical
  - Infrastructure

Courtesy of Prof Rothman and Dr De Palma

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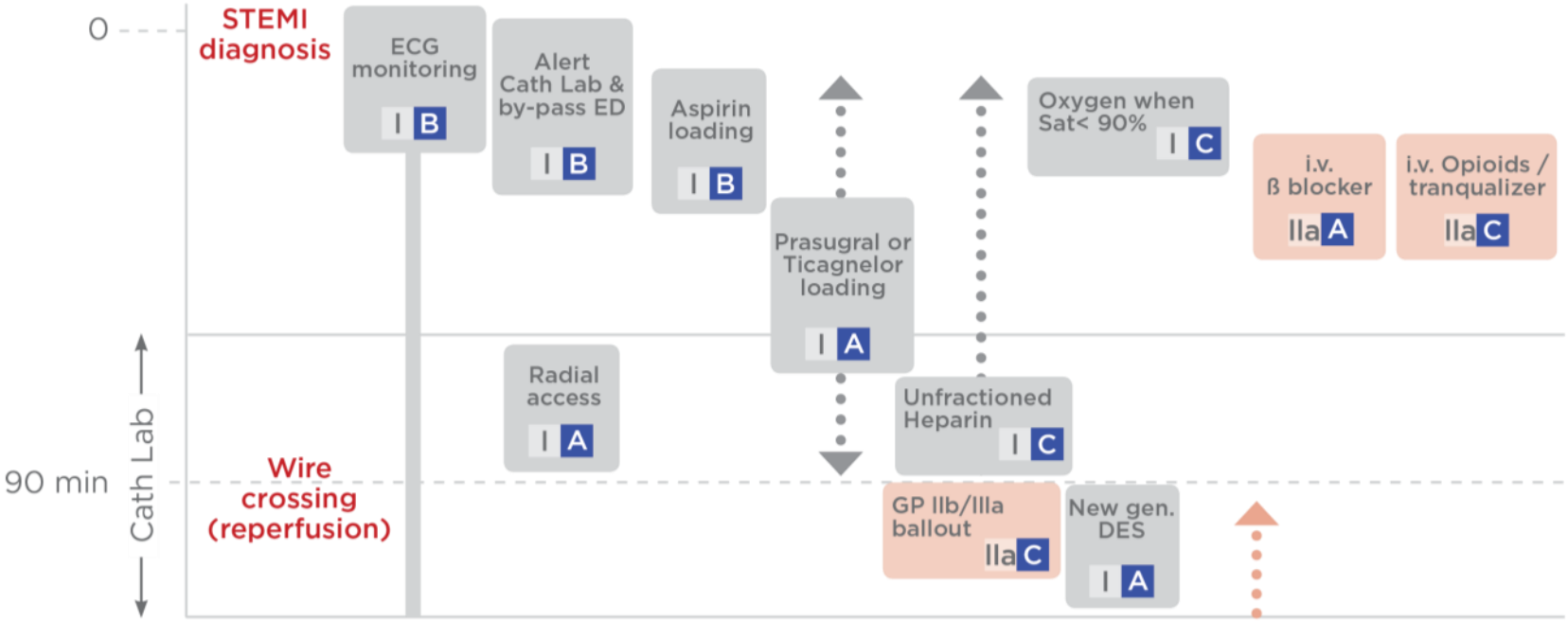
DO NOT FORGET ADDITIONAL INTERVENTIONS IN STEMI PATIENTS UNDERGOING A PRIMARY PCI STRATEGY

STRATEGY CLOCK



Adapted from

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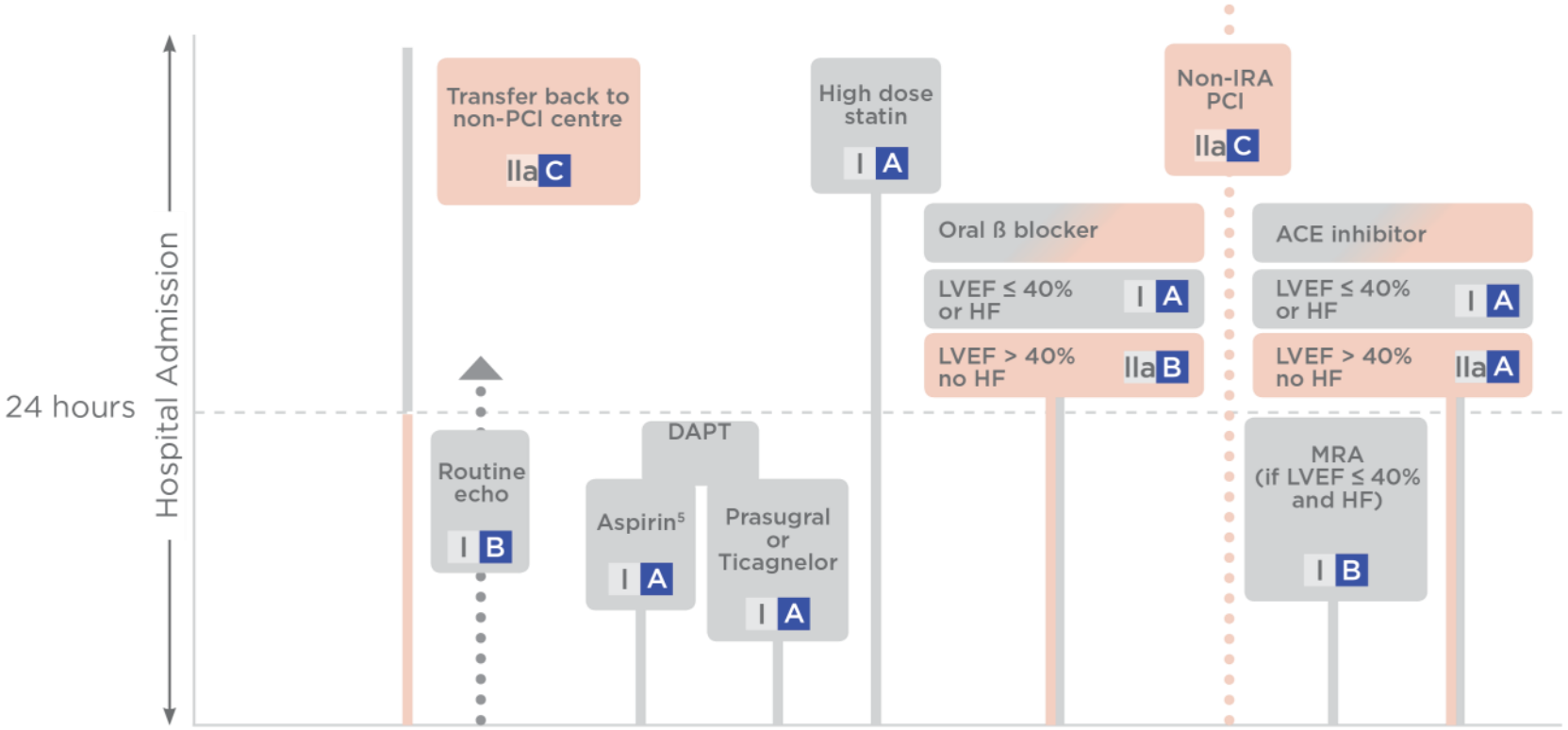
DO NOT FORGET ADDITIONAL INTERVENTIONS IN STEMI PATIENTS UNDERGOING A PRIMARY PCI STRATEGY



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DOSES OF ANTIPLATELET AND ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI

DOSES OF ANTIPLATELET AND PARENTERAL ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI

ANTIPLATELET THERAPIES

ASPIRIN	Loading dose of 150-500 mg orally or 75-250 mg i.v. if oral ingestion is not possible, followed by a maintenance dose of 75-100 mg/day.
CLOPIDOGREL	Loading dose of 600 mg orally, followed by a maintenance dose of 75 mg/day.
PRASUGREL	Loading dose of 60 mg orally, followed by a maintenance dose of 10 mg/day. In patients with body weight ≤ 60 kg, a maintenance dose of 5 mg/day is recommended. Prasugrel is contra-indicated in patients with previous stroke. In patients ≥75 years, prasugrel is generally not recommended, but a dose of 5 mg/day should be used if treatment is deemed necessary.

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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DOSES OF ANTIPLATELET AND ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI *(CONTINUED)*

DOSES OF ANTIPLATELET AND PARENTERAL ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI

ANTIPLATELET THERAPIES

TICAGRELOR	Loading dose of 180 mg orally, followed by a maintenance dose of 90 mg b.i.d.
ABCIXIMAB	Bolus of 0.25 mg/kg i.v. and 0.125µg/kg/min infusion (maximum 10 µg/min)for 12 hours.
EPTIFIBATIDE	Double bolus of 180 µg/kg i.v. (given at a 10-min interval) followed by an infusion of 2.0 µg/kg/min for up to 18 hours.
TIROFIBAN	25 µg/kg over 3 min i.v., followed by a maintenance infusion of 0.15 µg/kg/min for up to 18 hours.

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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DOSES OF ANTIPLATELET AND ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI *(CONTINUED)*

DOSES OF ANTIPLATELET AND PARENTERAL ANTICOAGULANT CO-THERAPIES IN PRIMARY PCI

ANTIPLATELET THERAPIES

UFH	70-100 IU/kg i.v. bolus when no GP IIb/IIIa inhibitor is planned 50-70 IU/kg i.v. bolus with GP IIb/IIIa inhibitors.
ENOXAPARIN	0.5 mg/kg i.v. bolus.
BIVA LIRUDIN	0.75 mg/kg i.v. bolus followed by i.v. infusion of 1.75 mg/kg/hour for up to 4 hours after the procedure.

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

PERIPROCEDURAL AND POSTPROCEDURAL ANTITHROMBOTIC THERAPY IN PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION

RECOMMENDATIONS	CLASS	LEVEL
ANTICOAGULANT THERAPY		
Anticoagulation is recommended for all patients in addition to antiplatelet therapy during primary PCI.	I	C
Routine use of UFH is recommended.	I	C
In patients with heparin-induced thrombocytopenia, bivalirudin is recommended as the anticoagulant agent during primary PCI.	I	C
Routine use of enoxaparin i.v. should be considered.	IIa	A
Routine use of bivalirudin should be considered.	IIa	A
Fondaparinux is not recommended for primary PCI.	III	B

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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GUIDANCE ON DRUG THERAPY FOR STEMI UNDERGOING PPCI

	Class 1	Class 2a	Class 2b	Class 3
Aspirin*	X			
Clopidogrel	X			
Heparin	X			
Bivalirudin				
Fondaparinux				X
Abciximab		X		
Eptifibatide			X	
Tirofiban			X	
Oxygen, Opiates	X			
Tranquiliser		X		

* Aspirin is a trademark of Bayer

Adapted from

Ibanez B, James S, Agewall S, Antunes M, Bucciarelli-Ducci C, Bueno H et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. European Heart Journal. 2017;39(2):119-177.

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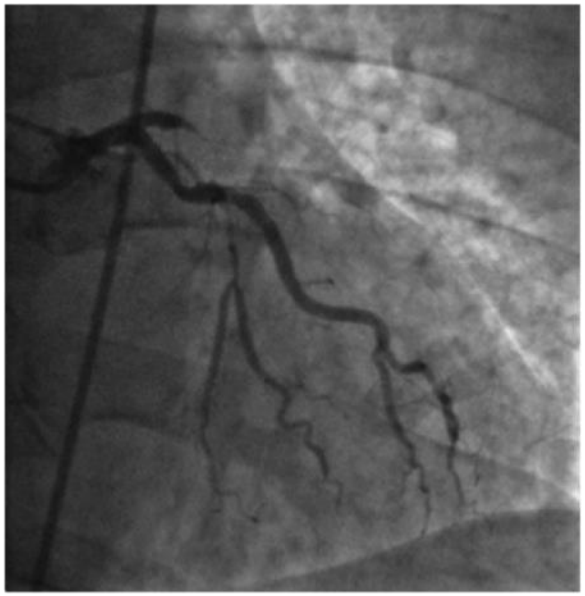
STEMI AS IT APPEARS ON A CORONARY ANGIOGRAM



- Definitive **DIAGNOSIS** made using the **ANGIOGRAM**
- In **EMERGENCY SITUATIONS** this can be completed in **<10 MINUTES**

Kammler J, Kypta A, Hofmann R, Kerschner K, Grund M, Sihorsch K et al. TIMI 3 flow after primary angioplasty is an important predictor for outcome in patients with acute myocardial infarction. Clinical Research in Cardiology. 2008;98(3):165-170.

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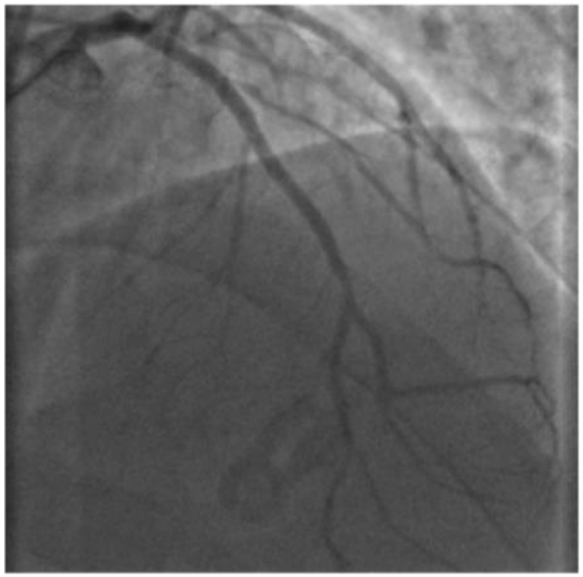
PPCI-ANGIOPLASTY / STENTING



- The **PPCI TREATMENT** involves **BALLOON INFLATION OR THROMBUS CATHETER ASPIRATION** to open the vessel
- In most cases a metal scaffold called a stent is implanted to keep the vessel open

Kammler J, Kypta A, Hofmann R, Kerschner K, Grund M, Sihorsch K et al. TIMI 3 flow after primary angioplasty is an important predictor for outcome in patients with acute myocardial infarction. Clinical Research in Cardiology. 2008;98(3):165-170.

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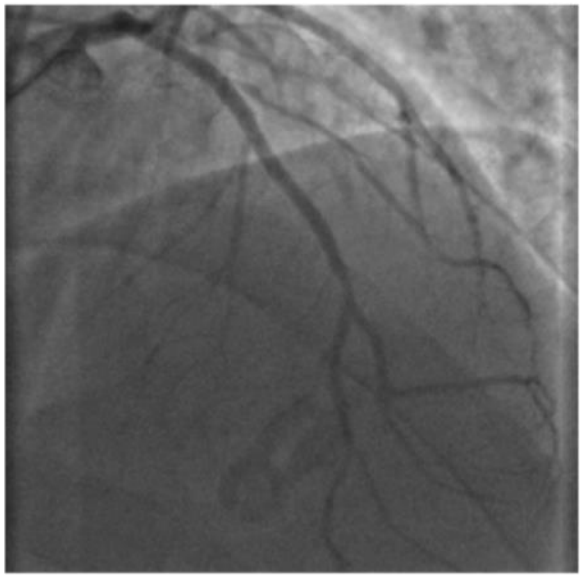
PPCI END RESULT



- The **AIM OF PPCI** is to **REOPEN THE PREVIOUSLY BLOCKED ARTERY AND REESTABLISH ANTEROGRADE CORONARY BLOOD FLOW** in the infarct related artery
- When normal flow is re-established this is known as **TIMI 3 FLOW**

Kammler J, Kypta A, Hofmann R, Kerschner K, Grund M, Sihorsch K et al. TIMI 3 flow after primary angioplasty is an important predictor for outcome in patients with acute myocardial infarction. Clinical Research in Cardiology. 2008;98(3):165-170.

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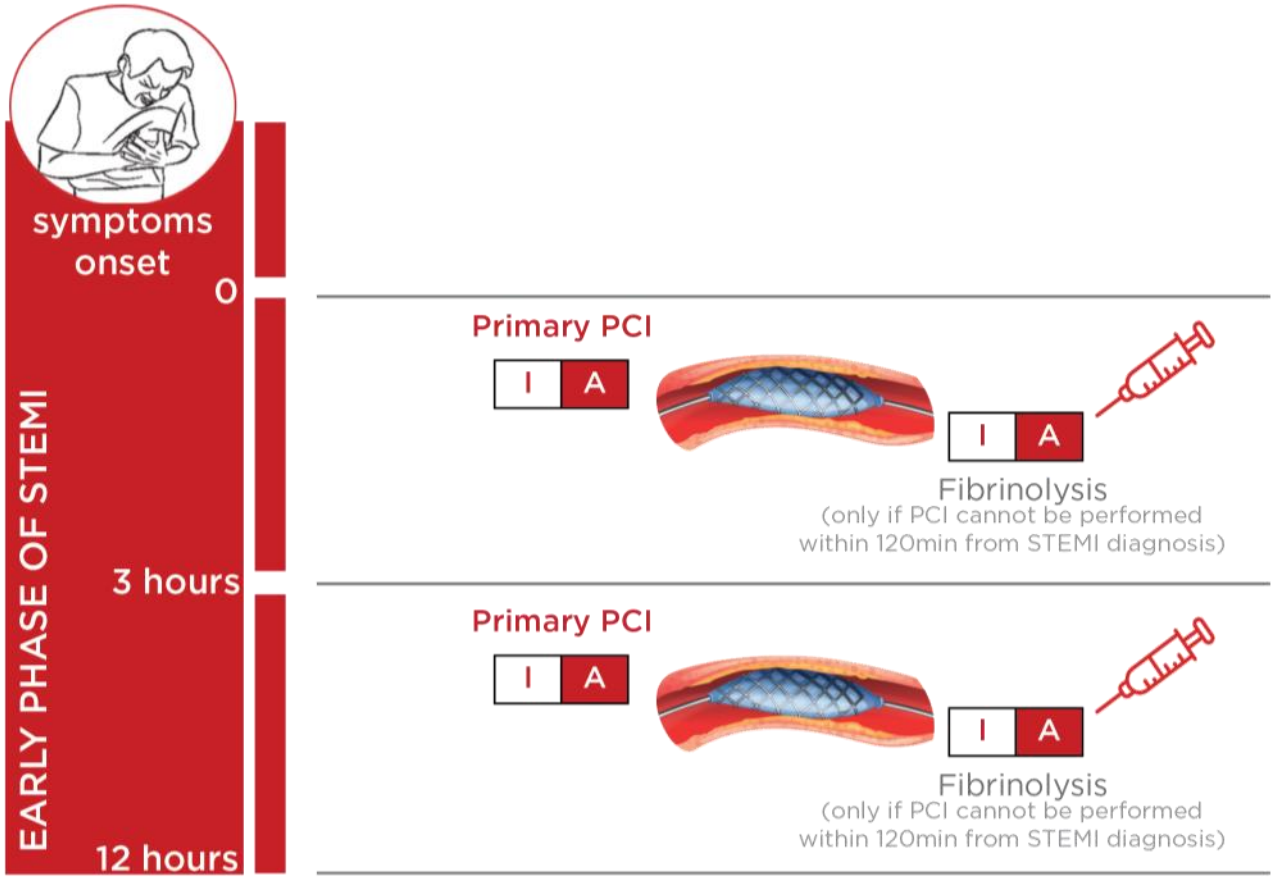
REPERFUSION STRATEGIES IN THE INFARCT-RELATED ARTERY ACCORDING TO TIME FROM SYMPTOMS ONSET



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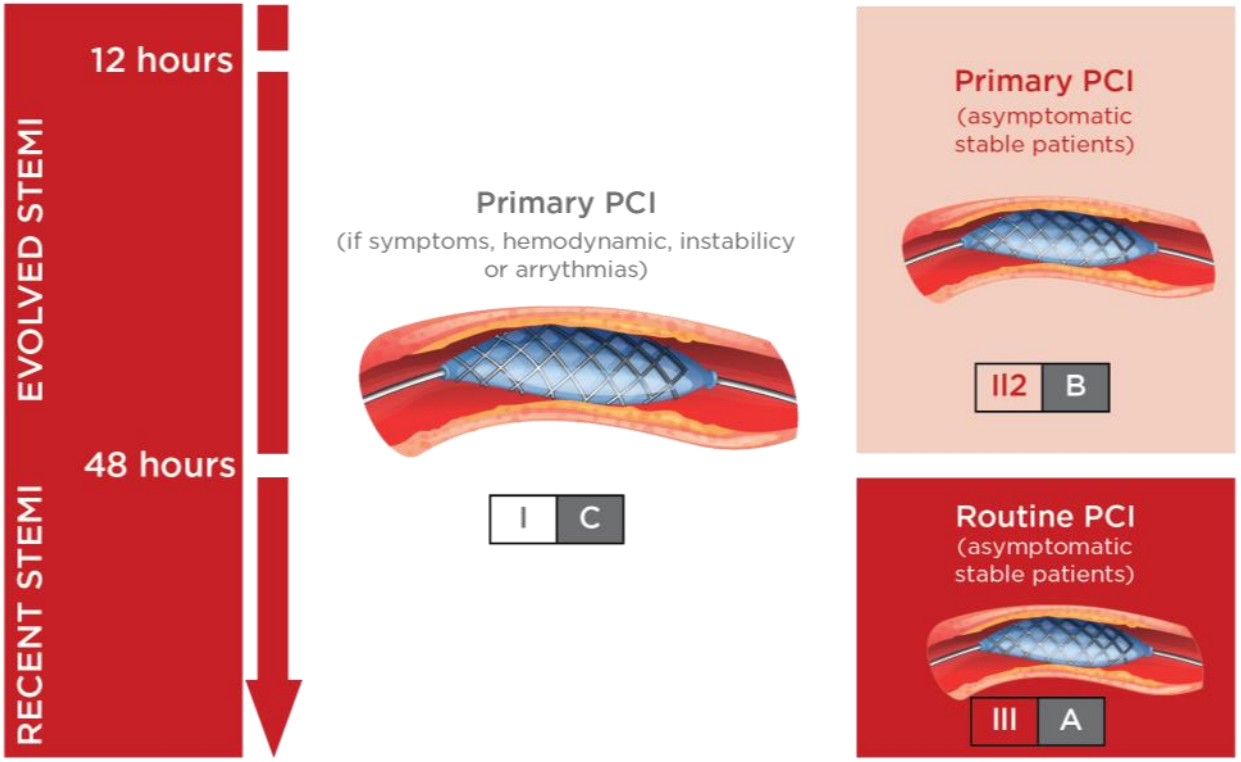
REPERFUSION STRATEGIES IN THE INFARCT-RELATED ARTERY ACCORDING TO TIME FROM SYMPTOMS ONSET *(CONTINUED)*



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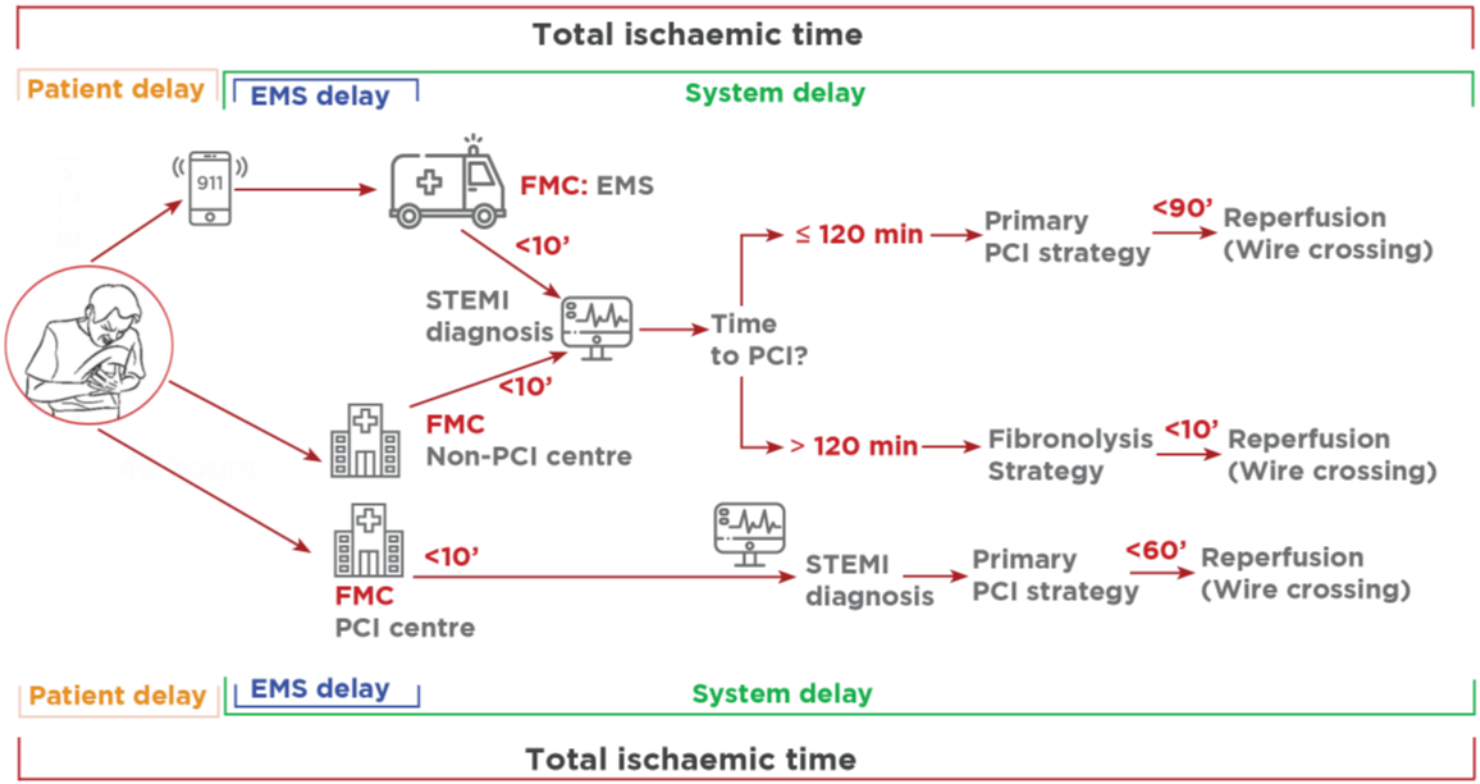
MODES OF PATIENT PRESENTATION, COMPONENTS OF ISCHAEMIC TIME AND FLOWCHART FOR REPERFUSION STRATEGY SLECTION



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