

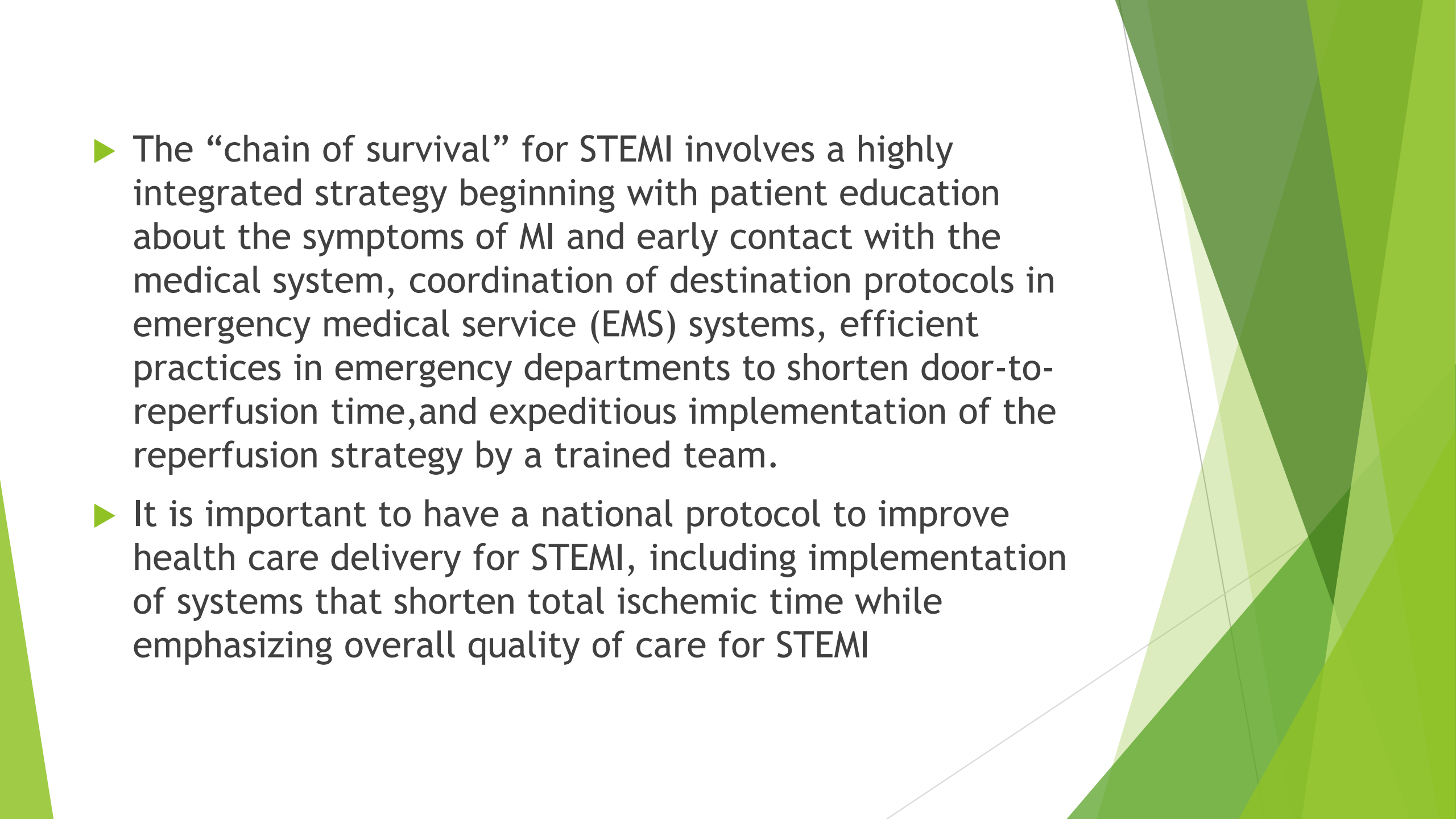
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# Acute Myocardial Infarction Initial Management and Therapeutic Strategies

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# Prehospital Management

- ▶ Given the progressive loss of functioning myocytes with persistent occlusion of the infarct-related artery, in STEMI, initial management aims to restore blood flow to the infarct zone as rapidly, as possible.
- ▶ Primary PCI is generally the preferred option, provided that an experienced operator and team can perform it in timely fashion.
- ▶ Missed opportunities for improvement in the care of STEMI, include failure to deliver any form of reperfusion therapy in approximately 15% of patients and failure to minimize delays in reperfusion because of inefficient systems of care

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- The background of the slide features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.
- ▶ The “chain of survival” for STEMI involves a highly integrated strategy beginning with patient education about the symptoms of MI and early contact with the medical system, coordination of destination protocols in emergency medical service (EMS) systems, efficient practices in emergency departments to shorten door-to-reperfusion time, and expeditious implementation of the reperfusion strategy by a trained team.
  - ▶ It is important to have a national protocol to improve health care delivery for STEMI, including implementation of systems that shorten total ischemic time while emphasizing overall quality of care for STEMI

# Criteria for a System of Care for ST-Elevation Myocardial Infarction (STEMI)

- ▶ 1. The system should be registered with Mission: Lifeline.
- ▶ 2. Ongoing multidisciplinary team meetings should occur, including EMS, non-PCI hospitals/ST EMI referral centers, and PCI hospitals/ST EMI receiving centers, to evaluate outcomes and quality improvement data. Operational issues should be reviewed, problems identified, and solutions implemented.
- ▶ 3. Each ST EMI system should include a process for prehospital identification and activation, destination protocols to ST EMI receiving centers, and transfer for patients who arrive at ST EMI referral centers and are primary PCI candidates, are ineligible for fibrinolytic therapy, and/or are in cardiogenic shock.
- ▶ 4. Each system should have a recognized system coordinator, physician champion, and EMS medical director.
- ▶ 5. Each system component (EMS, ST EMI referral centers, and ST EMI receiving centers) should meet the appropriate criteria.

# Interventions to Improve Door-to-Device Times

- ▶ 1. A prehospital ECG for diagnosing ST EMI is used to activate the PCI team while the patient is en route to the hospital.
- ▶ 2. Emergency physicians activate the PCI team.
- ▶ 3. A single call to a central page operator activates the PCI team.
- ▶ 4. A goal is set for the PCI team to arrive at the catheterization laboratory within 20 minutes after being paged.
- ▶ 5. Timely data feedback and analysis are provided to members of the ST EMI care team.

# Prehospital Care

- ▶ The prehospital care of patients suspected of having STEMI bears directly on the likelihood of survival.
- ▶ Most deaths associated with STEMI occur within the first hour of its onset and usually result from ventricular fibrillation (VF)
- ▶ Therefore, immediate implementation of resuscitative efforts and rapid transportation of the patient to a hospital have prime importance


# Major components of the time from the onset of ischemic symptoms to reperfusion

- ▶ (1) the time for the patient to recognize the problem and seek medical attention;
- ▶ (2) prehospital evaluation, treatment, and transportation;
- ▶ (3) the time for diagnostic measures and initiation of treatment in the hospital (e.g., “door-to-needle” time for patients receiving a fibrinolytic agent and “door-to-device” time for patients undergoing a catheter-based reperfusion strategy);
- ▶ (4) the time from initiation of treatment to restoration of flow.

## Patient-related factors that correlate with a longer delay until deciding to seek medical attention

- ▶ older age;
- ▶ female sex;
- ▶ black race;
- ▶ low socioeconomic
- ▶ uninsured status
- ▶ history of angina, diabetes, or both;
- ▶ consulting a spouse or other relative;
- ▶ and consulting a physician

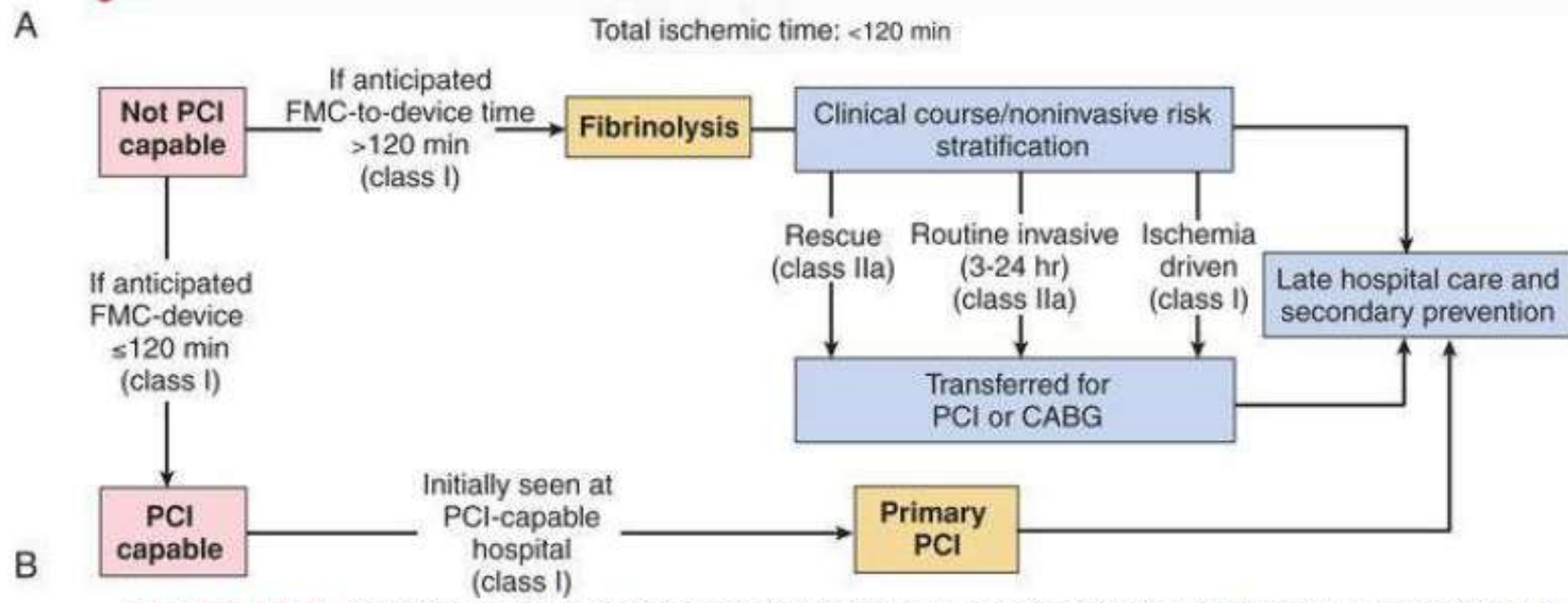
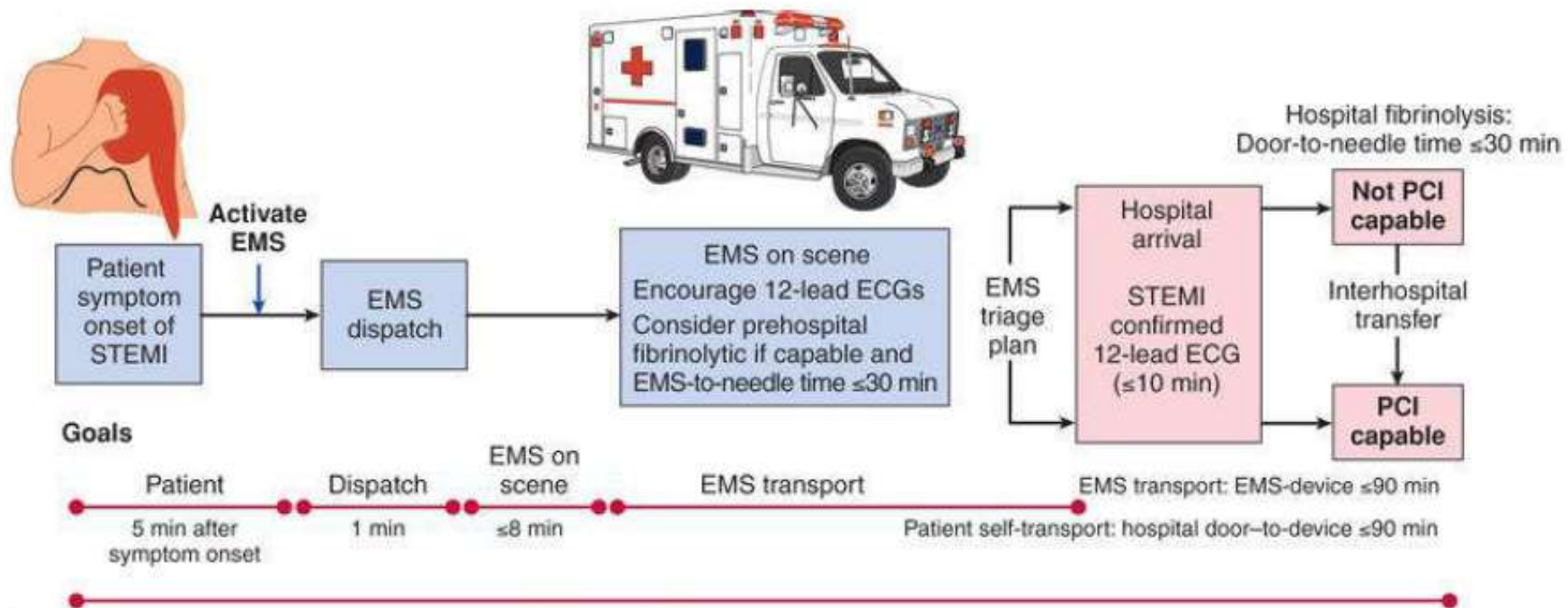


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- ▶ Health care professionals should heighten the level of awareness of patients at risk for STEMI (e.g., those with hypertension, diabetes, history of angina pectoris).
  - ▶ They should use each patient encounter as a “teachable moment” to review and reinforce with patients and their families the need to seek urgent medical attention , for a pattern of symptoms that includes chest discomfort, extreme fatigue, and dyspnea.
  - ▶ Patients should also be instructed in the proper use of sublingual nitroglycerin and to call emergency services if the ischemic-type discomfort persists for more than 5 minutes.

# Emergency Medical Service Systems

- ▶ EMS systems have three major components: emergency medical dispatch, first response, and the EMS ambulance response
- ▶ The expanded capability to record a prehospital 12-lead electrocardiogram (ECG) represents a major advance in EMS systems
- ▶ The ability to transmit such ECGs and to activate the STEMI care team before arrival at the hospital places EMS efforts at the center of the early response to STEMI

- ▶ Ongoing efforts to shorten the time until treatment of patients with STEMI include improvement in the medical dispatch component by expanding 115 coverage, providing automated external defibrillators to first responders, placing automated external defibrillators in critical public locations, and greater coordination of the EMS ambulance response.
- ▶ Well-equipped ambulances and helicopters staffed by personnel trained in the acute care of patients with STEMI allow definitive therapy to begin during transport to the hospital.
- ▶ Radiotelemetry systems that allow transmission of the electrocardiographic signal to a medical control officer facilitate the triage of patients with STEMI



- ▶ The STEMI systems goal is to maintain a network of transportation and destination hospitals so that the total ischemic time is kept to less than 120 minutes.
- ▶ Patient self-transportation is discouraged
- ▶ In addition to prompt defibrillation, the efficacy of prehospital care appears to depend on several factors, including :
  - ▶ early relief of pain with its deleterious physiologic sequelae,
  - ▶ reduction of excessive activity of the autonomic nervous system,
  - ▶ and treatment of arrhythmias such as ventricular tachycardia(VT)
- ▶ but these efforts must not delay rapid transfer to the hospital  
(Fig

مادر ترزا:

عشق را در همه جا پخش کن:

ابتدا داخل خانه ات؛ به همسر و فرزندان عشق بورز.

سپس عشق خود را به اطرافیان تشار کن.

مبادا کسی نزد تو بیاید و بعد از رفتن بهتر و شادتر از قبل نباشد.

نمونه زنده مهربانی خداوند باش.

باید مهربانی در چهره ات؛ چشمانت؛ لبخندت و برخوردت با دیگران موج بزند.


# Management in the Emergency Department

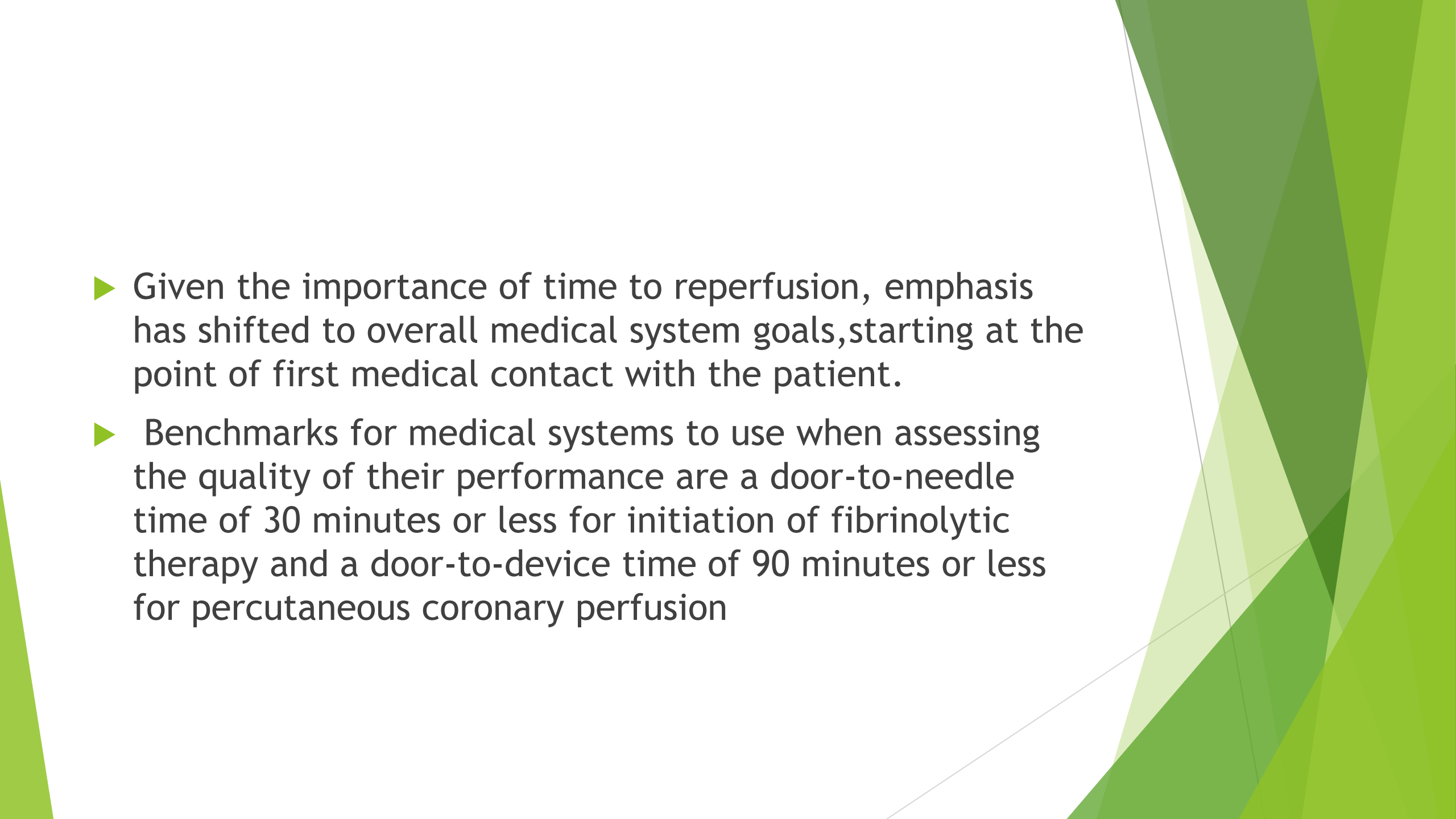
- ▶ When evaluating patients with chest pain in the emergency department (ED), physicians must confront the difficult tasks of rapidly identifying patients who require urgent reperfusion therapy, triaging lower-risk patients to the appropriate setting within the hospital, and not discharging patients inappropriately while avoiding unnecessary admissions.
- ▶ A history of ischemic-type discomfort and the initial 12-lead ECG are the primary tools for screening patients with possible acute coronary syndrome (ACS) for STEMI

- ▶ Because the 12-lead ECG is at the center of the decision pathway for initiation of reperfusion therapy, it should be obtained promptly ( $\leq 10$  minutes after hospital arrival) in patients with suspected ischemic symptoms.
- ▶ More extensive use of prehospital 12-lead ECGs has also facilitated early
- ▶ triage of patients with STEMI. Because lethal arrhythmias can occur suddenly in patients with STEMI, all patients should have bedside monitoring of the ECG and intravenous (IV) access.



- ▶ The presence of ST-segment elevation on the ECG in a patient with ischemic discomfort highly suggests thrombotic occlusion of an epicardial coronary artery and should trigger a well-rehearsed sequence of rapid assessment of the patient for initiation of a reperfusion strategy.
- ▶ Critical factors that weigh into selection of a reperfusion strategy include the time elapsed since the onset of symptoms, the risk associated with STEMI, the risk related to administering a fibrinolytic, and the time required to initiate an invasive strategy

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- ▶ In non-PCI-capable hospitals, the initial assessment should include evaluation of the contraindications to administration of a fibrinolytic
  - ▶ Patients with an initial ECG that reveals ST-segment depression and/or T wave inversion without ST-segment elevation are not considered candidates for immediate reperfusion therapy unless a posterior injury current is suspected

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- ▶ Given the importance of time to reperfusion, emphasis has shifted to overall medical system goals, starting at the point of first medical contact with the patient.
  - ▶ Benchmarks for medical systems to use when assessing the quality of their performance are a door-to-needle time of 30 minutes or less for initiation of fibrinolytic therapy and a door-to-device time of 90 minutes or less for percutaneous coronary perfusion

- ▶ In patients with a clinical history suggestive of STEMI and an initial nondiagnostic ECG (i.e., no ST-segment deviation or T wave inversion), serial tracings should be obtained during evaluation in the ED.
- ▶ ED staff can seek the sudden development of ST-segment elevation by periodic visual inspection of the bedside electrocardiographic monitor, by continuous ST segment recording, or by auditory alarms when the ST-segment deviation exceeds programmed limits.
- ▶ Decision aids such as computer-based diagnostic algorithms, identification of high-risk clinical indicators, rapid determination of cardiac biomarkers, echocardiographic evaluation for regional wall motion abnormalities, and myocardial perfusion imaging have greatest clinical usefulness when the findings on the ECG are not diagnostic.

# General Treatment Measures

- ▶ Aspirin
- ▶ Control of Cardiac Pain
- ▶ Initial management of patients with STEMI should target relief of pain and its associated heightened sympathetic activity.
- ▶ Control of cardiac pain is typically achieved with a combination of analgesics (e.g., morphine) and interventions to favorably improve the balance of myocardial oxygen supply and demand, including oxygen (in the setting of hypoxia), nitrates, and in appropriately selected patients, betaadrenergic receptor-blocking agents (beta blockers).

# Analgesics

- ▶ Although a wide variety of analgesic agents, including meperidine, pentazocine, and morphine, can treat the pain associated with STEMI, morphine remains the drug of choice, except in patients with well documented morphine hypersensitivity.
- ▶ Doses of 4 to 8 mg administered intravenously initially, followed by doses of 2 to 8 mg repeated at intervals of 5 to 15 minutes have been recommended until the pain is relieved or side effects emerge—hypotension, depression of respiration, or vomiting.
- ▶ Appropriate dosing of morphine sulfate will vary, however, depending on the patient's age, body size, blood pressure(BP), and heart rate (HR).

- ▶ Reduction of anxiety with successful analgesia diminishes the patient's restlessness and the activity of the autonomic nervous system, with a consequent reduction in the heart's metabolic demands, and possible favorable effects on myocardial healing
- ▶ Morphine has beneficial effects in patients with pulmonary edema as a result of peripheral arterial and venous dilation (particularly in those with excessive sympathoadrenal activity);
- ▶ It reduces the work of breathing and slows the HR secondary to combined withdrawal of sympathetic tone and augmentation of vagal tone.
- ▶ Counterbalancing these potential benefits, observational studies have suggested an association between the administration of morphine and adverse outcomes in patients with ACS, with the putative mechanism being a slowing of antiplatelet agent absorption.

- ▶ Maintaining the patient in a supine position and elevating the lower extremities if BP falls can minimize hypotension following the administration of nitroglycerin and morphine.
- ▶ Such positioning is undesirable in patients with pulmonary edema, but morphine rarely produces hypotension in these circumstances.
- ▶ IV administration of atropine may be helpful in treating excessive vagomimetic effects of morphine.



# Nitrates

- ▶ By virtue of their ability to enhance coronary blood flow by coronary vasodilation and to decrease ventricular preload by increasing venous capacitance, sublingual (SL) nitrates are indicated for most patients with an ACS.
- ▶ At present, the only groups of patients with STEMI in whom SL nitroglycerin should *not* be given are those with suspected right ventricular (RV) infarction or marked hypotension (e.g., systolic BP <90 mm Hg), especially if accompanied by bradycardia

- ▶ Once hypotension is excluded, an SL nitroglycerin tablet should be administered and the patient observed for improvement in symptoms or change in hemodynamics.
- ▶ If an initial dose is well tolerated and appears to be beneficial, further nitrates should be administered while monitoring vital signs.
- ▶ Even small doses can produce sudden hypotension and bradycardia, a reaction that can usually be reversed with IV atropine.
- ▶ Long-acting oral nitrate preparations should be avoided in the early course of STEMI, because of the frequently changing hemodynamic status of the patient.
- ▶ In patients with a prolonged period of waxing and waning chest pain, IV nitroglycerin may help control the symptoms and correct the ischemia, but frequent monitoring of BP is required.
- ▶ Initiation of a reperfusion strategy in patients with STEMI should not be delayed while assessing the patient's response to SL or IV nitrates.

# Beta-Adrenergic Blocking Agents

- ▶ Beta blockers aid in the relief of ischemic pain, reduce the need for analgesics in many patients, and reduce infarct size and life-threatening arrhythmias.
- ▶ Avoiding early IV beta blockers in patients with Killip class II or greater is important, however, because of the risk of precipitating cardiogenic shock.
- ▶ Routine use of IV beta blockers is no longer recommended in patients with STEMI, but IV administration of a beta blocker at the initial evaluation of patients with STEMI who are hypertensive and have ongoing ischemia is reasonable.

- ▶ A practical protocol for use of a beta blocker in this situation follows:
- ▶ First, exclude patients with heart failure (HF), hypotension (systolic BP <90 mm Hg), bradycardia (HR <60 beats/min), or significant atrioventricular (AV) block.
- ▶ Second, administer metoprolol in three 5-mg IV boluses.
- ▶ Third, observe the patient for 2 to 5 minutes after each bolus, and if HR falls below 60 beats/min or systolic BP falls below 100 mm Hg, do not administer any further drug.
- ▶ Fourth, if hemodynamic stability continues 15 minutes after the last IV dose, begin oral metoprolol tartrate, 25 to 50 mg every 6 hours for 2 to 3 days as tolerated, and then switch to 100 mg twice daily.

- ▶ Lower doses may be used in patients who have a partial decline in BP with the initial dosing or who appear to be at higher risk (e.g., larger infarction) for development of HF because of poor left ventricular (LV) performance.
- ▶ Infusion of an extremely short acting beta blocker, such as esmolol, 50 to 250  $\mu\text{g}/\text{kg}/\text{min}$ , may be useful in patients with relative contraindications to the administration of a beta blocker and in whom HR slowing is considered highly desirable.

# Oxygen

- ▶ Hypoxemia can occur in patients with STEMI and generally results from ventilation-perfusion abnormalities that are sequelae of LV failure;
- ▶ concomitant intrinsic pulmonary disease may also contribute to hypoxemia in some patients.
- ▶ Treating all patients hospitalized for STEMI with oxygen for at least 24 to 48 hours is common practice based on the empiric assumption of hypoxia and evidence that increased oxygen in the inspired air may protect ischemic myocardium

- ▶ However, augmentation of the fraction of oxygen in inspired air ( $FI_{O_2}$ ) does not elevate  $O_2$  delivery significantly in patients who are not hypoxemic.
- ▶ Furthermore, it may increase systemic vascular resistance and arterial pressure, promote coronary vasoconstriction, and result in greater oxidative stress.
- ▶ Moreover, in a randomized trial comparing oxygen (8 L/min) with no supplemental oxygen in 441 patients with STEMI but without hypoxia, compared with the control therapy, supplemental  $O_2$  therapy demonstrated a trend toward increased early myocardial injury measured with cardiac troponin

- ▶ In a secondary analysis, O<sub>2</sub> supplementation was associated with increased myocardial infarct size assessed by cardiac magnetic resonance imaging (CMR) at 6 months.
- ▶ In view of these considerations, arterial oxygen saturation (SaO<sub>2</sub>) can be estimated by pulse oximetry, and O<sub>2</sub> therapy can be omitted if the oximetric findings are normal.
- ▶ On the other hand, patients with STEMI and arterial hypoxemia (e.g. SaO<sub>2</sub> <90%) should receive oxygen.
- ▶ In patients with severe pulmonary edema, endotracheal intubation and mechanical ventilation may be necessary to correct the hypoxemia and reduce the work of breathing.



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