2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology

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Task Force Members

- 19 Authors
- ESC
- 30 Reviewers
- -1224 comments and requests

Level of evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Data derived from multiple randomized clinical trials or meta-analyses.</td>
</tr>
<tr>
<td>B</td>
<td>Data derived from a single randomized clinical trial or large non-randomized studies.</td>
</tr>
<tr>
<td>C</td>
<td>Consensus of opinion of the experts and/or small studies, retrospective studies, registries.</td>
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159 recommendations based on 477 references

- **A**: 37 (23%)
- **B**: 44 (28%)
- **C**: 78 (49%)
## 2017 NEW / REVISED CONCEPTS

### MINOCA AND QUALITY INDICATORS:
- New chapters dedicated to these topics.

### STRATEGY SELECTION AND TIME DELAYS:
- Clear definition of first medical contact (FMC).
- Definition of “time 0” to choose reperfusion strategy (i.e. the strategy clock starts at the time of “STEMI diagnosis”).
- Selection of PCI over fibrinolysis: when anticipated delay from “STEMI diagnosis” to wire crossing is ≤120 min.
- Maximum delay time from “STEMI diagnosis” to bolus of fibrinolysis agent is set in 10 min.
- “Door-to-Balloon” term eliminated from guidelines.

### TIME LIMITS FOR ROUTINE OPENING OF AN IRA:
- 0-12h (Class I); 12-48h (Class IIa); >48h (Class III).

### ELECTROCARDIOGRAM AT PRESENTATION:
- Left and right bundle branch block considered equal for recommending urgent angiography if ischaemic symptoms.

### TIME TO ANGIOGRAPHY AFTER FIBRINOLYSIS:
- Timeframe is set in 2-24h after successful fibrinolysis.

### PATIENTS TAKING ANTICOAGULANTS:
- Acute and chronic management presented.
Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

Total ischaemic time

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>FMC</td>
<td>The time point when the patient is either initially assessed by a physician, paramedic, nurse or other trained EMS personnel who can obtain and interpret the ECG, and deliver initial interventions (e.g. defibrillation). FMC can be either in the prehospital setting or upon patient arrival at the hospital (e.g. emergency department).</td>
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ΣΑΣ ΠΑΡΑΛΑΜΒΑΝΟΥΜΕ ΑΠΟ ΟΠΟΥ ΘΕΛΕΤΕ

AIRLINES
PALAIOKOSTAS
Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

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<td>STEMI diagnosis</td>
<td>The time at which the ECG of a patient with ischaemic symptoms is interpreted as presenting ST-segment elevation or equivalent.</td>
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Ambiguous terms are eliminated:
“Door-to-balloon”
“Door to door”

STEMI diagnosis

FMC: EMS
≤10’

FMC: Non-PCI centre
≤10’

FMC: PCI centre
≤10’

STEMI diagnosis

EMS delay

System delay

Total ischaemic time

Patient delay

FMC:

STEMI diagnosis

≤120 min

>120 min

Time to PCI?

≤90'

>90’

STEMI diagnosis

≤60'

>60’

Reperfusion

Primary PCI strategy

<60’

Reperfusion (Wire crossing)
Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

**Atypical ECG presentations**

- Bundle branch block,
- Ventricular pacing,
- Hyper-acute T waves,
- Isolated depression in anterior leads,
- Universal ST depression with aVR elevation

In the presence of symptoms, a primary PCI strategy (urgent angiography and PCI if indicated) should be followed.

**Left and right bundle branch block are considered equal for recommending urgent angiography if ischaemic symptoms.**

- **<120 min**
  - Time to PCI?
  - STEMI diagnosis
  - ≤90’ Primary PCI strategy
  - <10’ Reperfusion (Wire crossing)

- **>120 min**
  - ≥90’ System delay
  - ≤60’ Primary PCI strategy
  - <10’ Reperfusion (Lytic bolus)
  - ≤60’ Reperfusion (Wire crossing)
Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

### Modes of patient presentation

#### Components of ischaemic time

- **Patient delay**
- **EMS delay**
- **System delay**

#### Total ischaemic time

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<th>Time Limit</th>
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<td>Patient delay</td>
<td>≤120 min</td>
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<tr>
<td>EMS delay</td>
<td>&gt;120 min</td>
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<tr>
<td>System delay</td>
<td>≤10 min</td>
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### In the absence of ST-segment elevation

A *primary PCI strategy* is indicated in patients with suspected ongoing ischaemic symptoms if:
- haemodynamic instability or cardiogenic shock,
- recurrent or ongoing chest pain refractory to medical treatment,
- life-threatening arrhythmias or cardiac arrest,
- mechanical complications of myocardial infarction,
- acute heart failure,
- recurrent dynamic ST-segment or T-wave changes, particularly with intermittent ST-segment elevation.

**Class I**  
**Level C**

![Reperfusion (Wire crossing)](image-url)  
![Reperfusion (Lytic bolus)](image-url)  
![Reperfusion (Wire crossing)](image-url)
Reperfusion strategies in the infarct-related artery according to time from symptoms onset

**Early phase of STEMI**

0 hours

- **Primary PCI**
  - I A

- **Fibrinolysis** *(only if PCI cannot be performed within 120 min from STEMI diagnosis)*
  - I A

3 hours

- **Primary PCI**
  - I A

12 hours

- **Primary PCI**
  - I A

- **Fibrinolysis** *(only if PCI cannot be performed within 120 min from STEMI diagnosis)*
  - I A
Reperfusion strategies in the infarct-related artery according to time from symptoms onset (continued)

Evolved STEMI

Primary PCI
(if symptoms, hemodynamic instability, or arrhythmias)

Primary PCI
(asymptomatic stable patients)

Recent STEMI

Primary PCI
(asymptomatic stable patients)

Routine PCI
(asymptomatic stable patients)

12 hours

48 hours

I C

IIa B

III A

## What is new in 2017 Guidelines on AMI-STEMI

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**Graph A:**
- Valgimigli et al. Lancet 2015;385:2465-76

**Graph B:**
- Rate ratio 0.83; 95% CI 0.73–0.96, p=0.0092
- Number at risk: Femoral access 4197, Radial access 4189
- Days since randomisation: 0, 5, 10, 15, 20, 25, 30
- Cumulative incidence (%)

### References
- Valgimigli et al. Lancet 2015;385:2465-76
### What is new in 2017 Guidelines on AMI-STEMI

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**Sabate et al. Lancet 2012;380:1482-90**

- BMS: Baseline myocardial infarction
- Target-vessel myocardial infarction
- Target-vessel revascularisation
- Stent thrombosis HR 2.70 (95% CI 1.05-6.90); P= x2=0.03
- 1=1; p=0.0169

**From day to day EES**

- Number entered BM: 751
- Number entered SES: 741
- Number entered EES: 736
- Number entered 1051
- Number entered 0: 718
- Number entered 1: 708
- Number entered 2: 699
- Number entered 3: 689
- Number entered 4: 679
- Number entered 5: 669
- Number entered 6: 659
- Number entered 7: 649
- Number entered 8: 639
- Number entered 9: 629
- Number entered 10: 619
- Number entered 11: 609
- Number entered 12: 599
- Number entered 13: 589
- Number entered 14: 579
- Number entered 15: 569
- Number entered 16: 559
- Number entered 17: 549
- Number entered 18: 539
- Number entered 19: 529
- Number entered 20: 519
- Number entered 21: 509
- Number entered 22: 499
- Number entered 23: 489
- Number entered 24: 479
- Number entered 25: 469
- Number entered 26: 459
- Number entered 27: 449
- Number entered 28: 439
- Number entered 29: 429
- Number entered 30: 419
- Number entered 31: 409
- Number entered 32: 399
- Number entered 33: 389
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- Number entered 35: 369
- Number entered 36: 359
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- Number entered 52: 199
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- Number entered 54: 179
- Number entered 55: 169
- Number entered 56: 159
- Number entered 57: 149
- Number entered 58: 139
- Number entered 59: 129
- Number entered 60: 119
- Number entered 61: 109
- Number entered 62: 99
- Number entered 63: 89
- Number entered 64: 79
- Number entered 65: 69
- Number entered 66: 59
- Number entered 67: 49
- Number entered 68: 39
- Number entered 69: 29
- Number entered 70: 19
- Number entered 71: 0
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**CHANGE IN RECOMMENDATIONS**

- **Radial access**: MATRIX
- **DES over BMS**: PRAMI, DANAMI-3-PRIMULTI, CVLPRIT, Compare-Acute
- **Complete Revascularization**: EXAMINATION, COMFORTABLE-AMI, NORSTENT

**Additional Changes**

- **Oxygen when $\text{SaO}_2 < 90\%$**: AVOID, DETO2X
- **Oxygen when $\text{SaO}_2 < 95\%$**: TOTAL, TASTE
- **Bivalirudin**: MATRIX, HEAT-PPCI
- **Enoxaparin**: ATOLL, Meta-analysis
- **Complete Revascularization**: Small trials & observational data
- **Discharge**: Oxygen when $\text{SaO}_2 < 90\%$
- **Inferior MI**: Half dose i.V. in Pts ≥75 years
- **STEEN**: STREAM

**Additional Figures**

- **Graph**
  - Engstrom et al, Lancet 2015
  - HR 0.56 (95% CI 0.38–0.83), p=0.004

**Additional References**

- Engstrom et al, Lancet 2015
What is new in 2017 Guidelines on AMI-STEMI

2012

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**2012**
- Same dose i.V. in all patients
- Half dose i.V. in Pts ≥ 75 years

**2017**
- STREAM: Oxygen when SaO2 < 95%
- AVOID, DETOX: Oxygen when SaO2 < 90%

- PRAMI, DANAMI-3-PRIMULTI, CVLPRIT, Compare-Acute
- TOTAL, TASTE

**EXAMINATION, COMFORTABLE-AMI, NORSTENT**
- MATRIX
- PRAMI
- DANAMI-3-PRIMULTI
- CVLPRIT
- Compare-Acute
- TOTAL
- TASTE

**Small trials & observational data**
- MATRIX DES over BMS

**Complete Revascularization**
- PCI + TA
- PCI

Frobert et al, NEJM 2013
- Cumulative Risk of Death from Any Cause (%)
  - PCI
  - PCI + TA

Jolly et al, NEJM 2015
- Primary Outcome
  - PCI alone
  - Thrombectomy
  - PCI alone

No. at Risk
- PCI + TA: 3621, 3568, 3540, 3532, 3526, 3524, 3519
- PCI: 3623, 3567, 3545, 3530, 3523, 3517, 3513

TNK-tPA

Management of AMI-STEMI (EU)
What is new in 2017 Guidelines on AMI-STEMI

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What is new in 2017 Guidelines on AMI-STEMI

**CHANGE IN RECOMMENDATIONS 2012 - 2017**

- **Same dose i.V in all patients**
  - Enoxaparin: 278/13,943
  - Unfractionated heparin: 622/17,023
- **Half dose i.V. in Pts ≥ 75 years**
  - Enoxaparin: 765/13,943
  - Unfractionated heparin: 1115/17,023
- **Bivalirudin**
- **Enoxaparin**
- **PrimerPCI for STEMI**
  - Death: 112/3590
  - Complications of myocardial infarction: 96/3590
  - Major bleeding: 92/3499
  - Minor bleeding: 138/3216
- **Oxygen when SaO2 <95%**
- **OXYGEN**
- **Early Hospital Discharge**
- **Silvain et al, BMJ 2012**
- **TNK-tPA**
- **Half dose i.V. in Pts ≥ 75 years**
- **STREAM**

**www.escardio.org/guidelines**

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OXYGEN
What is new in 2017 Guidelines on AMI-STEMI

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**STubb et al, Circ 2015**
What is new in 2017 Guidelines on AMI-STEMI

2017 NEW RECOMMENDATIONS

- Additional lipid lowering therapy if LDL >1.8 mmol/L (70 mg/dL) despite on maximum tolerated statins. **IMPROVE-IT, FOURIER**
- Complete revascularization during index primary PCI in STEMI patients in shock. Expert opinion

- Cangrelor if P2Y$_{12}$ inhibitors have not been given. **CHAMPION**
- Switch to potent P2Y$_{12}$ inhibitors 48 hours after fibrinolysis. Expert opinion
- Extend Ticagrelor up to 36 months in high-risk patients. **PEGASUS-TIMI 54**
- Use of polypill to increase adherence. **FOCUS**
- Routine use of deferred stenting. **DANAMI 3-DEFER**
What is new in 2017 Guidelines

2017 NEW RECOMMENDATIONS

• Additional lipid lowering therapy if LDL >1.8 mmol/L (70 mg/dL) despite on maximum tolerated statins. **IMPROVE-IT, FOURIER**

• Cangrelor if P2Y$_{12}$ inhibitors have not been given. **CHAMPION**

• Switch to potent P2Y$_{12}$ inhibitors 48 hours after fibrinolysis. Expert opinion

• Extend Ticagrelor up to 36 months in high-risk patients. **PEGASUS-TIMI 54**

• Use of polypill to increase adherence. **FOCUS**

• Complete revascularization during index primary PCI in shock. Expert opinion

• Routine use of deferred stenting. **DANAMI 3-DEFER**

What is new in 2017 Guidelines on AMI-STEMI

• Cangrelor if P2Y12 inhibitors have not been given.

CHAMPION
• Switch to potent P2Y12 inhibitors 48 hours after fibrinolysis. Expert opinion

• Extend Ticagrelor up to 36 months in high-risk patients. **PEGASUS-TIMI 54**

• Use of polypill to increase adherence. **FOCUS**

• Complete revascularization during index primary PCI in STEMI patients in shock. Expert opinion

• Routine use of deferred stenting. **DANAMI 3-DEFER**
“Do not forget” interventions in STEMI patients undergoing a primary PCI strategy
Diagnostic test flow chart in MINOCA

**SUSPECTED STEMI**

**ACUTE INVESTIGATION**

- Coronary stenosis $\geq 50\%$
- Urgent angiography
- No Coronary stenosis $\geq 50\%$ + Fulfilment universal AMI criteria

**MINOCA**

- Treat as STEMI
- Acute LV wall motion assessment (angiogram/echo)
www.escardio.org/guidelines

Full Text
ESC Pocket Guidelines App and much more...

AMI-STEMI
Guidelines for the Management of Acute Myocardial Infarction in Patients Presenting with ST-Segment Elevation
Διάρκεια 12 μήνες
(1/10/05 – 31/9/06)

n: 359 (άνδρες 82%)

Άφιξη από την έναρξη των συμπτωμάτων <3 h

<3 h
Primary PCI
Athens area

Athens area

<table>
<thead>
<tr>
<th>Year</th>
<th>% pPCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>31%</td>
</tr>
<tr>
<td>2010</td>
<td>42%</td>
</tr>
<tr>
<td>2011</td>
<td>59%</td>
</tr>
<tr>
<td>2015</td>
<td>70%</td>
</tr>
</tbody>
</table>
# STEMI pPCI patients

## Time Delays

### Thrombolysis

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms – FMC</td>
<td>136.91 min</td>
<td>125.5 min</td>
<td>136 min</td>
</tr>
<tr>
<td>FMC – needle</td>
<td></td>
<td>62.17 min</td>
<td>65.5 min</td>
</tr>
<tr>
<td></td>
<td>36 min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### pPCI

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms – FMC</td>
<td>142.41 min</td>
<td>131.26 min</td>
<td>125 min</td>
</tr>
<tr>
<td>FMC – PCI center</td>
<td>129.11 min</td>
<td>119.21 min</td>
<td>78 min</td>
</tr>
<tr>
<td>Door – Balloon</td>
<td>53.41 min</td>
<td>53.1 min</td>
<td>55 min</td>
</tr>
<tr>
<td>FMC – Balloon</td>
<td>182.52 min</td>
<td>172.31 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>133 min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ESC Pocket Guidelines App

Anytime - Anywhere

• All ESC Pocket Guidelines
• Over 140 interactive tools
  - Algorithms
  - Calculators
  - Charts & Scores
• Summary Cards & Essential Messages
• Online & Offline

Learn more on the Guidelines area
HELIOS 2005-6
Επαναίματωση σε STEMI

- Lysis 50%
- p PCI 9%
- No Rx 41%
- prPCI 24%
- Θρ/λυση 43%
- 65%
2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation
Ratio Total PCI/Primary PCI: 2007-2015

- 2008: 1723 (8.8% PCI, 2056 pPCI)
- 2009: 2611 (10.2% PCI, 2568 pPCI)
- 2010: 2056 (15.5% PCI, 2056 pPCI)
- 2011: 2611 (23% PCI, 16120 pPCI)
- 2012: 3733 (25% PCI, 14279 pPCI)
- 2013: 3678 (20% PCI, 18386 pPCI)

Note: The percentage values are approximate and may not sum up exactly due to rounding.
Classes of recommendations

<table>
<thead>
<tr>
<th>Classes</th>
<th>Definition</th>
<th>Suggested wording</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.</td>
<td>Recommended/is indicated.</td>
</tr>
<tr>
<td><strong>Class IIa</strong></td>
<td>Weight of evidence/opinion is in favour of usefulness/efficacy.</td>
<td>Should be considered.</td>
</tr>
<tr>
<td><strong>Class IIb</strong></td>
<td>Usefulness/efficacy is less well established by evidence/opinion.</td>
<td>May be considered.</td>
</tr>
<tr>
<td>Class III</td>
<td>Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.</td>
<td>Not recommended.</td>
</tr>
</tbody>
</table>

159 recommendations

- Class I: 92 (58%)
- Class IIa: 38 (24%)
- Class IIb: 13 (8%)
- Class III: 16 (10%)
What is new in 2017 Guidelines on AMI-STEMI

2017 NEW / REVISED CONCEPTS

MINOCA AND QUALITY INDICATORS:
• New chapters dedicated to these topics.

STRATEGY SELECTION AND TIME DELAYS:
• Clear definition of first medical contact (FMC).
• Definition of “time 0” to choose reperfusion strategy (i.e. the strategy clock starts at the time of “STEMI diagnosis”).
• Selection of PCI over fibrinolysis: when anticipated delay from “STEMI diagnosis” to wire crossing is ≤120 min.
• Maximum delay time from “STEMI diagnosis” to bolus of fibrinolysis agent is set in 10 min.
• “Door-to-Balloon” term eliminated from guidelines.

TIME LIMITS FOR ROUTINE OPENING OF AN IRA:
• 0-12h (Class I); 12-48h (Class IIa); >48h (Class III).

ELECTROCARDIOGRAM AT PRESENTATION:
• Left and right bundle branch block considered equal for recommending urgent angiography if ischaemic symptoms.

TIME TO ANGIOGRAPHY AFTER FIBRINOLYSIS:
• Timeframe is set in 2-24h after successful fibrinolysis.

PATIENTS TAKING ANTICOAGULANTS:
• Acute and chronic management presented.
Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

- **Patient delay**
  - **EMS delay**
    - FMC: EMS <10’
    - STEMI diagnosis <10’
  - FMC: Non-PCI centre <10’
  - FMC: PCI centre <10’

- **Total ischaemic time**
  - **System delay**
    - ≤120 min
    - ≤90’ Primary PCI strategy
    - ≤60’ Reperfusion (Wire crossing)
    - >120 min
    - <10’ Fibrinolysis strategy
    - <10’ Reperfusion (Lytic bolus)
    - ≤120 min
    - <10’ Reperfusion (Wire crossing)

- **Time to PCI?**
  - ≥120 min
  - ≤60’ Reperfusion (Wire crossing)

Reperfusion strategies in the infarct-related artery according to time from symptoms onset

Primary PCI (if symptoms, hemodynamic instability, or arrhythmia)

Fibrinolysis (only if PCI cannot be performed within 120 min from STEMI diagnosis)

Primary PCI (asymptomatic stable patients)

Routine PCI (asymptomatic stable patients)

Primary PCI (asymptomatic stable patients)

Primary PCI (asymptomatic stable patients)

Primary PCI (asymptomatic stable patients)

Fibrinolysis (only if PCI cannot be performed within 120 min from STEMI diagnosis)

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Primary PCI

Fibrinolysis

Primary PCI

Fibrinolysis

Primary PCI

Fibrinolysis