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# ST ELEVATION MYOCARDIAL INFARCTION: THROMBOLYSIS IN ANY LOCATION WITH AVAILABLE MEDICATION

## *INFARTO AGUDO DO MIOCÁRDIO COM SUPRA DE ST: TROMBÓLISE EM QUALQUER LOCAL QUE A MEDICAÇÃO ESTEJA DISPONÍVEL*

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## ABSTRACT

Cardiovascular events, especially acute myocardial infarction, are the main cause of death in our country. In addition to its physiopathogenesis and the involved risk factors, the 30-day mortality rates vary from 3% to 5% in advanced centers and 30% in those where care does not apply the recommended guidelines. Such change will depend on organizational improvement, as well as patient education, professionals in the emergency department, and harmony with agents in the public or private health system. Primary angioplasty is the gold standard treatment for myocardial reperfusion, but is only available in 15% of hospitals. If it is not available in the public sector, a pharmacoinvasive strategy – fibrinolytic therapy followed by patient transfer for angioplasty – has been recommended. Diagnosis is based on ECG criteria, but there is a shortage of physicians qualified for such confirmation. This delays the treatment and compromises the results. Telemedicine or teleECG allows distant professionals to corroborate with the diagnosis, guide the treatment, and obtain quality and mortality metrics. The rapid identification of patients with signs and symptoms of acute myocardial infarction, immediate diagnosis on ECG, and fibrinolytic administration should not exceed 20 min. They are life-saving minutes dependent on prior organization. Fibrinolytic treatment is the reality for a country with continental dimensions and transport logistic limitations. It is the responsibility of health managers to make them available to the care of patients with infarction.

**Keywords:** Fibrinolytics; Acute Myocardial Infarction, Reperfusion.

## RESUMO

*As doenças cardiovasculares, especialmente, o infarto agudo do miocárdio, são responsáveis pela primeira causa de óbito em nosso país. Baseando-se em sua fisiopatogenia e nos fatores de risco envolvidos, a taxa de mortalidade, em 30 dias, varia de 3-5% em centros avançados e quase 30% naqueles cujo atendimento não aplicam as diretrizes recomendadas. Tal mudança dependerá de um aprimoramento organizacional com ações educativas para o paciente, profissionais do setor de emergência e plena sintonia com os gestores do sistema de saúde público ou privado. A angioplastia primária é o tratamento padrão-ouro da reperfusão miocárdica, porém, disponível apenas em 15% dos hospitais. Em geral, o setor público carece dessa disponibilidade, sendo a estratégia fármaco-invasivo - terapia fibrinolítica seguida da transferência precoce para angioplastia –a recomendada. O diagnóstico baseia-se em critérios eletrocardiográficos, porém, nem sempre há médicos habilitados para tal confirmação. Isso retarda o tratamento e compromete bastante os resultados. A disponibilidade da telemedicina ou teleECG permite que profissionais mesmo à distância possam corroborar com o diagnóstico, orientar o tratamento e obter métricas de qualidade e mortalidade. A rápida identificação do paciente com sinais e sintomas de infarto agudo, diagnóstico imediato no ECG e administração do fibrinolítico não devem ultrapassar 20 minutos. São minutos dependentes da prévia organização que salvam vidas! O tratamento fibrinolítico é a realidade para um país com dimensões continentais e sérias limitações logísticas de transporte. Compete aos gestores de saúde disponibilizá-lo a qualquer hora ou momento para o atendimento do paciente infartado.*

***Descritores:*** *Fibrinolíticos; Infarto Agudo do Miocárdio; Reperfusão.*



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## INTRODUCTION

Reperfusion therapy is the main objective in the treatment of ST-segment elevation myocardial infarction (STEMI), based on findings in recent decades.[1,2]

Fissures in atherosclerotic plaques trigger a series of events that culminate in coronary occlusion. Exposure of thrombogenic substances such as collagen and tissue factors, activates the coagulation cascade, beginning with platelet adhesion and aggregation leading to thrombus formation. This process occurs in seconds and is a primarily vascular event, which has repercussions on the heart muscle.

The wave of necrosis originates from the subendocardial layer, which consumes an elevated amount of energy and spreads to the epicardial region, thus characterizing a transmural myocardial infarction. It usually occurs within a hours of the infarction, depending on factors such as the presence of collateral circulation and the supply/consumption ratio of oxygen through the myocardium.[3]

The earlier reperfusion therapy (mechanical or pharmacoinvasive procedure) is performed, the smaller the necrotic area and thus the better the prognosis. This disease is the leading cause of death in developed or developing countries.[4,5] Sudden death observed within the first hour of symptoms is secondary to electrical instability and cardiac arrest due to ventricular fibrillation. Other complications include cardiogenic shock, mechanical dysfunction, heart failure, and complex ventricular arrhythmias.[6]

In some European countries (e.g., France, Portugal, Italy), mortality rates due to infarction have declined in recent decades to as low as 3% to 5%. This reflects the organization of healthcare logistics including pre-hospital care, unified protocols, training, central regulation, and commitment to care.[7]

In our country, the National Association of Private Hospitals, which includes almost 90 hospitals with international quality certification (JOINT Commission), also demonstrates mortality rates between 3% and 5%.[8] Unlike the nation's reality, the public healthcare system, with some exceptions, lacks diagnostic flowcharts, institutional protocols, central regulation, or professionals who are able to interpret the diagnosis for infarction using electrocardiogram (ECG). In some regions, death rates are at 30%, which is comparable to rates prior to the advent of thrombolysis.[9] In our context, training for doctors and nurses working in public hospitals that do not have the resources for primary angioplasty but have an organized system to transfer patients to a tertiary hospital after administration of thrombolytic drugs, results in a significant decrease in mortality due to acute myocardial infarction (AMI) and a shorter hospitalization period.[10]

In spite of evidence surrounding high quality healthcare, we find that many centers lack equipment in emergency sectors (defibrillator, intubation materials, ventilators, electrocardiographs, vasoactive drugs, cardiac monitors, temporary pacemakers, and fibrinolytic drugs) and coronary units and have a lack of qualified professionals to provide the best treatment.

## REPERFUSION TREATMENT

Although primary angioplasty represents the gold standard of reperfusion therapy, due to limited human resources, there are estimates that only 15% of Brazilian hospitals have a hemodynamic laboratory that is fully available for 24 hours a day, 7 days a week.

If the primary healthcare center has such a facility, it is best to recanalize the artery within 60 minutes of infarction. Compared to fibrinolytic therapy, this procedure results in high recanalization rates (nearly 100%), plaque stabilization with a drug-eluting stent implant, low hemorrhage risk, risk stratification, and safe radial access. Otherwise, considering that the transfer time for primary angioplasty is less than 120 minutes, healthcare professionals should administer fibrinolytic therapy immediately.[11]

When the fibrinolytic agent is infused within the first 3 hours of the onset of symptoms, mortality rates are similar to that for primary angioplasty. This is particularly relevant for tenecteplase (TNK), a third-generation thrombolytic agent with a high specificity to fibrin linked to thrombus with a long half-life (20 min), and low central hemorrhage risk (0.5%), when doses are non-antigenic, adjusted by weight and age (≥75 years), and administered as bolus.[12]

Although the rate of artery recanalization varies from 60 to 70% (TIMI (thrombolysis in myocardial infarction) 3 flow) and is easily accessible and universally practiced, there is a 10% – 20% risk of reocclusion. This means that this strategy is not definitive, as there are limitations concerning recanalization and reocclusion rates.

Given these variables, a combined treatment (pharmacoinvasive procedure) is currently recommended considering fibrinolytic and associated with subsequent percutaneous intervention in centers which not have the resources for primary angioplasty.

Ideally, at the end of fibrinolytic therapy, the patient should be transferred to a hemodynamic center. It is not possible to predict which patients will have positive results or present with reocclusion, or how the state of their conditions will evolve within the next few hours following reperfusion therapy.

One of the main reperfusion criteria is resolution of ST-segment elevation of over 50% within 60 min to 90 min from the onset of infusion. The patient is then referred for angioplasty with a drug-eluting stent implant within two to twenty-four hours.[13]

For patients with little or no resolution of ST-segment elevation who present with persistent pain, signs of hemodynamic or electrical instability, or suspected reocclusion, rescue angioplasty must be immediately performed.

Patients with STEMI require attention and forward planning. Twenty minutes is enough to save lives! The first ten are needed to complete ECG and confirm diagnosis, and the other ten for fibrinolytic infusion. The initial first aid treatment and administration of adjuvant medication for reperfusion therapy are crucial.

## TWENTY MINUTES CAN SAVE LIVES!

Treatment for infarction is time-sensitive. Patients must recognize symptoms and seek medical attention immediately at a specialized unit in their area. This requires action by healthcare administrators to generate awareness. The slogan is "The right patient in the right place."

With the right information, there is quicker access to care. The ideal situation is artery recanalization within the first hour

of symptom onset (the golden hour).[14] The benefit of this treatment in reducing mortality declines over the first 12 hours and is borderline between 12 and 24 hours.[15] Based on coronary angiography, if TIMI 3 flow is fully achieved (full artery recanalization), the mortality rate varies from 3% to 4% in 30 days and 7% to 8% for TIMI 0.1 or 2 flow. In addition to epicardial coronary flow, we should also consider the myocardial flow, which is measured as the time taken for the contrast of the ventricular muscle to clear and is also a prognostic factor. Less time means better epicardial and myocardial perfusion. Therefore, when epicardial flow is equal to TIMI 3 and myocardial flow is equal to TMP 3, the mortality rate in 30 days is less than 3% percent.[16]

The dose of tenecteplase is adjusted for weight and age, while the dose of alteplase is adjusted for weight. Along with fibrinolytic therapy, 2 antiplatelet drugs (aspirin and clopidogrel) are given, along with enoxaparin. Clopidogrel and enoxaparin are also adjusted for weight and age. In patients who are 75 years or older, there is an increased risk for hemorrhage, which is the reason for this adjustment.

The double dose of antiplatelet drugs and enoxaparin reduce mortality in fibrinolytic therapy, as observed by improved recanalization rates and fewer incidences of reocclusion. There are not enough studies to support the recommendation of more potent antiplatelet agents when fibrinolytic therapy is applied.

Thus, there is no time to lose. We have 20 minutes between diagnosis and fibrinolytic infusion. Remember: Time is muscle, flow is life. Get organized! (Figure 1)

## WHAT IS NECESSARY FOR APPROPRIATE TREATMENT?

Organization, activities to raise patients' awareness, and a multi-professional team in the emergency sector. A healthcare system in synchronization with each center's needs is fundamental. (Table 1)

Table 1. Components for treating ST-segment elevation myocardial infarction (STEMI).

| |
|---|
| **Patient** |
| Recognize signs and symptoms (awareness campaigns) |
| Call for emergency services (in Brazil, SAMU - 192 or) |
| Head quickly to the Emergency Department in your region |
| **Emergency Department** |
| Immediately identify and attend to the patient with thoracic pain |
| Perform and interpret ECG in up to 10 min |
| Administer aspirin, clopidogrel, and enoxaparin |
| Administer fibrinolytic agent (rule out contraindications) in 10 min |
| Transfer patient to referral center after fibrinolytic treatment |
| Verify resolution (reduction ≥50 of ST-segment elevation) 60'-90 min after beginning fibrinolytic treatment |
| - If ≥50%: transfer for angioplasty within 2-24 hours |
| - If <50% or reocclusion: rescue angioplasty (urgent care) |
| Fill out the Checklist Form |
| Fill out the Transfer Form |
| Previously contacted Referral Center |
| Ensure transfer safety |
| **Healthcare System** |
| Raise patients' awareness to recognize symptoms of infarction through media |
| Population aware of location for specialized care |
| Ensure human resources and equipment work properly |
| Disclose and post healthcare and treatment flow charts |
| Provide ICU ambulance |
| Periodically train professionals in the emergency sector |
| Collect healthcare quality markers/indicators |
| Facilitate counter-referral (patient returns to originating center after angioplasty) |

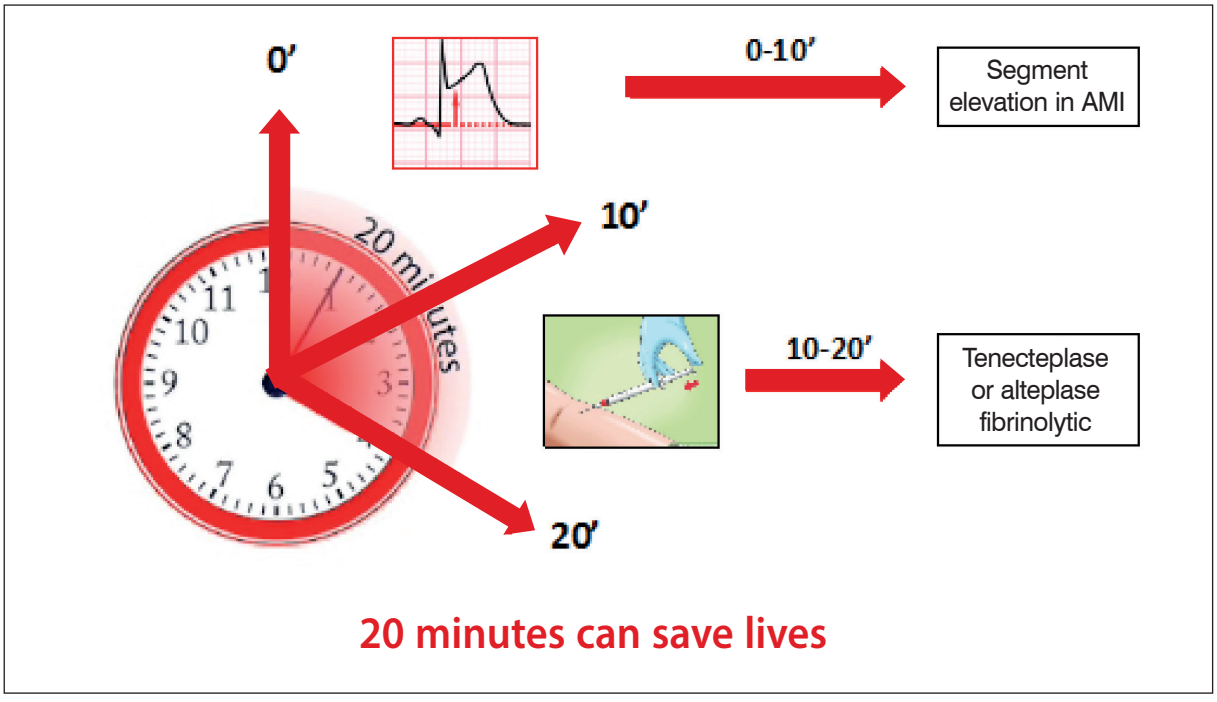


Figure 1. Fibrinolytic therapy in STEMI. Ten minutes for electrocardiographic diagnosis and another ten to administer fibrinolytic agent.

Flow charts (Annexes 1 and 2)

A. Centers without a hemodynamic laboratory or with a transfer time ≥120 min:

1. Immediate care for patient with thoracic pain, electrocardiographic diagnosis within 10 min of admission.
2. Administer "Fibrinolysis kit": aspirin, clopidogrel, enoxaparin, fibrinolytic agent (tenecteplase or alteplase) in the subsequent 10 min. Respect their contraindications.
3. Transfer the patient for angioplasty within 2 to 24 hours after diagnosis if resolution of ST-segment elevation is ≥50% (ECG taken 60-90 min after beginning fibrinolytic infusion)
4. Rescue angioplasty (urgent care) when there is no resolution ≥50% for ST-segment elevation and the patient presents with persistent pain, and electrical or hemodynamic instability.
5. Fill out the Checklist and Transfer Forms (Annexes 3 and 4).
6. Ensure patient safety in the ambulance and in the ICU.
7. Facilitate counter-referral (patient returns to originating hospital).

B. Centers with a hemodynamic laboratory or transfer time <120 min:

1. Administer double antiplatelet therapy: aspirin + clopidogrel or aspirin + ticagrelor or aspirin + prasugrel.
2. Transfer the patient for angioplasty in 120 min. Avoid passage through emergency department once diagnosis is made.
3. Primary angioplasty <60 min in centers with a hemodynamic laboratory
4. Administer unfractionated heparin in the hemodynamic room.
5. Prefer radial access, drug-eluting stent.
6. Fill out the Checklist Form.



### Fibrinolysis kit

It aims to expedite care for the patient with STEMI. It is administered within 10 min of electrocardiographic confirmation and is available for immediate administration. (Table 2)

Tenecteplase is a molecule derived from alteplase and comes with the advantage of bolus administration, a longer half-life, lower hemorrhage risk, and greater fibrin specificity, according to next article.

Table 2. Fibrinolysis kit.

| Medication | Dose |
|---|---|
| 100 mg Aspirin | 2 chewable tablets |
| 75 mg Clopidogrel | < 75 years – 4 tablets<br>≥ 75 years – 1 tablet |
| Enoxaparin | < 75 years – 30 mg IV + 1 mg/Kg SC 12/12h<br>≥ 75 years – 0.75 mg/Kg SC 12/12h |
| Tenecteplase<br>40 mg or 50 mg bottles | Rapid infusion (1-2 min.)<br>Total dose = 0.53 mg/kg (bolus)<br>< 60 kg = 30mg,<br>≥ 60 a 70 kg = 35mg<br>≥ 71 a 80 kg = 40mg<br>≥ 81 a 90 kg= 45mg<br>≥ 91 kg = 50mg<br>For patients ≥ 75 years: administer half the total dose |
| Alteplase<br>50 mg bottles | Accelerated infusion (90min.)<br>15 mg (bolus) + 0,75 mg/kg (30')<br>(maximum 50mg) + 0,5 mg/kg (60')<br>(maximum 35mg)<br>Do not exceed 100 mg |

### Primary angioplasty kit

Two antiplatelet agents are administered, based on institutional protocol:

1. 200 mg aspirin + 600 mg clopidogrel;
2. 200 mg aspirin + 180 mg ticagrelor; or
3. 200 mg aspirin + 60 mg prasugrel.

In general, the artery affected by infarction is recanalized within 48 hours of its evolved state and extended to 3 days for patients who still present with symptoms, hemodynamic instability, and complex ventricular arrhythmias. In multi-artery cases, the strategy is to offer staged treatment, depending each case's analysis.

Figure 2 illustrates examples of different STEMI scenarios and recommendations according to the European Society of Cardiology's recent guidelines and quality standards.[17,18]

As for the concomitant use of other medications, the following are recommended:

1. Oxygen – digital $O_2$ saturation <90% or $PaO_2$ <60 mmHg;
2. Nitrates - sublingual or systemic if patient presents with precordial pain, pulmonary congestion, if SBP (systolic blood pressure) >90 mmHg;
3. IV Morphine - 2 mg doses to control pain, pulmonary congestion, and anxiety;
4. Statins - high-potency (atorvastatin or rosuvastatin) to reduce LDL <70 mg/dL, administered within the first 24 hours of infarction;
5. Angiotensin-converting enzyme inhibitor or angiotensin I receptor blocker—in cases with ventricular dysfunction (EF <40%), they reduce risk of death and hospitalization;
6. Beta blocker: indicated for patients with LVEF (left ventricular ejection fraction) <40%, reduces risk of death, recurrence of infarction, and hospitalization;
7. Spironolactone - indicated when LVEF <40%, reduces risk of hospitalization and death. Avoid in patients with renal dysfunction and hyperkalemia;
8. Change habits, quit smoking.

After treatment, the patient remains under cardiac monitoring in the coronary unit for the first 24 hours. Patients without complications receive early hospital discharge.

## CONCLUSION

Reperfusion therapy is the main objective in treating ST-segment elevation myocardial infarction. The gold standard of treatment is primary angioplasty, but it is not always available, especially in the public healthcare system. In these cases, pharmacoinvasive treatment is recommended, wherein the administration of the fibrinolytic agent is quick, and the patient is transferred to a center with a hemodynamic laboratory.

An electrocardiographic diagnosis should be performed within 10 minutes, and two antiplatelet agents, enoxaparin and a fibrinolytic agent, should be administered within the subsequent 10 minutes; this results in two-thirds of artery recanalization.

Twenty minutes can save lives!

The fibrinolytic agent must be administered irrespective of the location or time when a hemodynamic laboratory is not available.

## CONFLICTS OF INTEREST

The author declares that he has no conflicts of interest in this work.

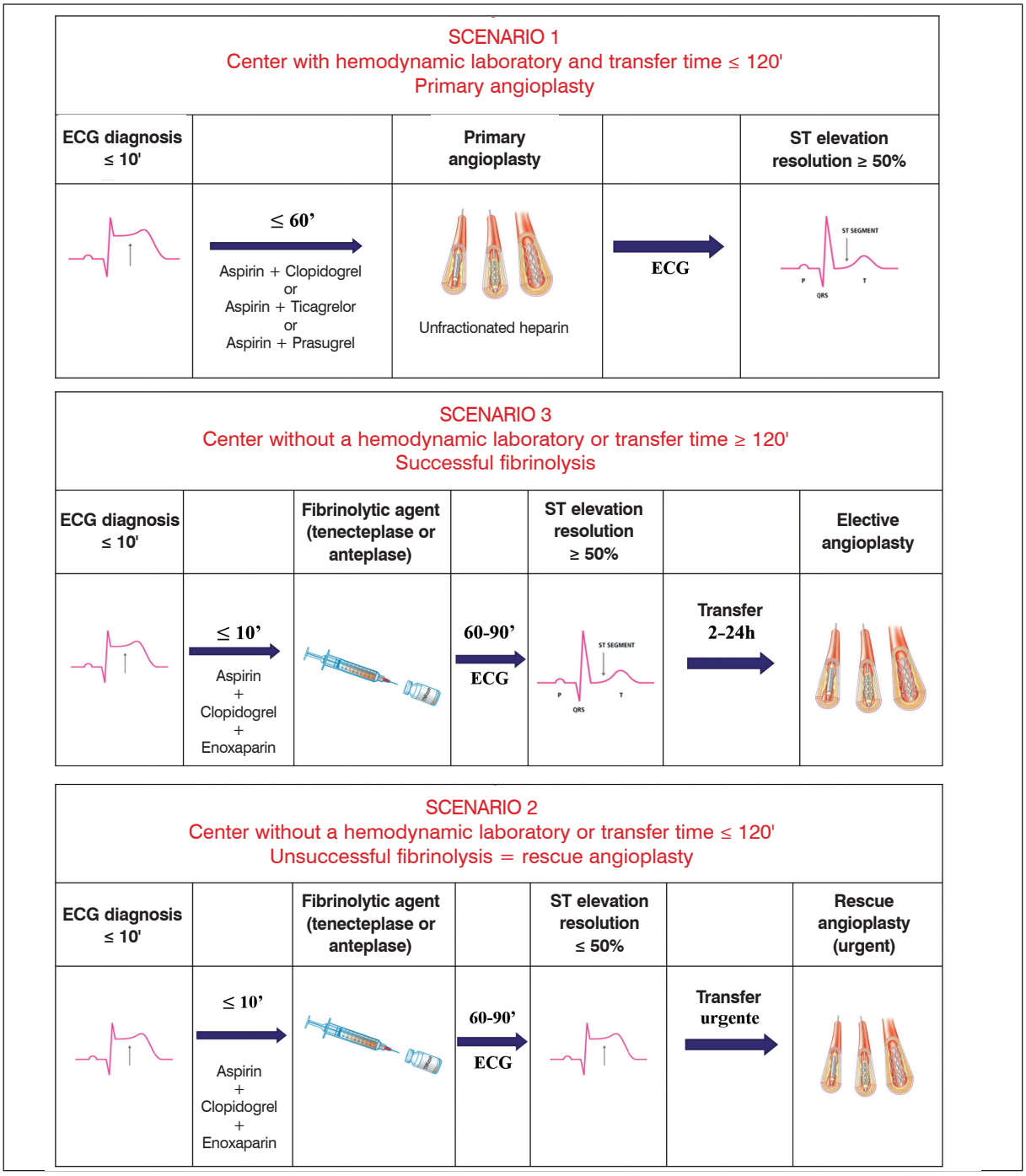


Figure 2.

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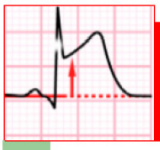
Annex 1.

SOCESP - PROJECT INFARCTION -



# ACUTE CORONARY SYNDROME WITH ST-SEGMENT ELEVATION PHARMACOINVASIVE TREATMENT TENECTEPLASE

## INCLUSION CRITERIA

0'

- Beginning of symptoms ≤ 12 hours
- Transfer time for primary angioplasty > 120 min.
- ECG: ST elevation (J point) ≥ 1.0 mm (≥ 2 contiguous derivations)
- In $V_2$-$V_3$ derivations, consider ST elevation:
  - Men: ≥ 2.5 mm < 40 years
    ≥ 2.0 mm < 40 years
  - Women: ≥ 1.5 mm
- LBBB or new RBBB
- ST elevation $V_3R$-$V_4R$ = RV infarction
- ST elevation $V_7$-$V_9$ ≥ 0.5 mm = dorsal infarction (generally ST depression $V_1$-$V_2$)

## EXCLUSION CRITERIA

- Any contraindication absolute to tenecteplase

## SPECIAL SITUATIONS

(indicate primary angioplasty)

- Symptoms ≥ 12 hours (pain or signs of persistent ischemia)
- Hemodynamic instability (hypotension, shock, pulmonary congestion)
- Complex ventricular arrhythmias
- High hemorrhage risk

10'

## TENECTEPLASE INFUSION*

(10 min. after ECG)

| < 75 years | ≥75 years |
|---|---|
| 200 mg aspirin + 300 mg clopidogrel + enoxaparin: (30 mg IV + 1mg/Kg SC 12/12h) | 200 mg aspirin + 75 mg clopidogrel + enoxaparin: (0.75 mg/Kg SC 12/12h) |
| + | + |
| Tenecteplase Complete dose | Tenecteplase 50% dose |

### TENECTEPLASE DOSE (IV bolus)

| | |
|---|---|
| < 60 Kg = 30mg = 6 ml | 80-89 Kg = 45mg = 9 ml |
| 60-69 Kg = 35mg = 7 ml | > 90 Kg = 50mg = 10 ml |
| 70-79 Kg = 40mg = 8 ml | |

**ST ELEVATION RESOLUTION > 50% at 60-90 min.?**
(after beginning infusion)

Yes → 120' ANGIOPLASTY in 2-24h

No → URGENT ANGIOPLASTY "RESCUE"

*Ideally, after tenecteplase, refer patient immediately to Referral Center

## FIBRINOLYTIC THERAPY: CONTRAINDICATIONS

### ABSOLUTE

- Hemorrhage via CNS
- CNS neoplasm (primary or metastatic)
- Vascular structural lesion in CNS
- Ischemic CVA < 6 months
- Aortic dissection (suspected or confirmed)
- Active bleeding (except menstruation)
- Gastrointestinal bleeding < 30 days
- Puncture or biopsy in non-compressible site (ex.: liver, kidneys, lower back < 24h)
- Coagulopathies
- TBI and/or face trauma < 30 days
- CNS surgery < 2 months

### RELATIVE

- SBP ≥ 180 mmHg or DBP ≥ 110 mmHg - refractory
- Prolonged or traumatic CPR
- Transient ischemic attack ≤ 6 months
- Active peptic ulcer
- Major surgery ≤ 3 weeks
- Pregnancy, abortion, or recent delivery < 7 days
- Oral anticoagulants
- Cocaine: prefer clinical treatment and/or angioplasty
- Endocarditis

## HEMORRHAGE RISK FACTORS

- Age ≥ 75 years
- Low body weight (men < 80 Kg, women < 67 Kg)
- Female

## INVASIVE PROCEDURE PRIMARY ANGIOPLASTY

- Time ≤ 60 min. in center with hemodynamic lab or
- Transfer time < 120 min.

(200 mg aspirin + 600 mg clopidogrel) or
(200 mg aspirin + 180 mg ticagrelor) or
(200 mg aspirin + 60 mg prasugrel)
+
unfractionated heparin (hemodynamic room)
70-100 IU/Kg IV (maximum 5,000 IU)

CLINICAL | STENT | SURGICAL

AFTER TENECTEPLASE AND TRANSFER DELAY, MAINTAIN

- 100 mg/day aspirin + 75 mg/day clopidogrel + 1mg/kg enoxaparin 12/12h (1 mg/kg/day if ClCr < 30 ml/min.) until Coronary Angiography or until hospital discharge or until the 8th day if still hospitalized.
- Prasugrel: contraindicated: previous CVA/TIA > 75 years.
  Weight ≤ 60 kg = 5 mg/day (special cases)

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Annex 2.

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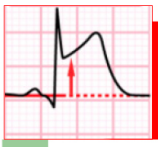

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| + | + |

**ALTEPLASE**

15 mg IV bolus +
0.75 mg/Kg IV 30 min. (at 50 mg) +
0.50 mg/Kg IV 60 min. (at 35 mg)

**ST ELEVATION RESOLUTION > 50% at 60-90 min.?**
(after beginning infusion)

Yes → 120'

**ANGIOPLASTY in 2-24h**

No →

**URGENT ANGIOPLASTY "RESCUE"**

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- Transient ischemic attack ≤ 6 months
- Active peptic ulcer
- Major surgery ≤ 3 weeks
- Pregnancy, abortion, or recent delivery < 7 days
- Oral anticoagulants
- Cocaine: prefer clinical treatment and/or angioplasty
- Endocarditis

## HEMORRHAGE RISK FACTORS

- Age ≥ 75 years
- Low body weight (men < 80 Kg, women < 67 Kg)
- Female

## INVASIVE PROCEDURE PRIMARY ANGIOPLASTY

- Time ≤ 60 min. in center with hemodynamic lab or
- Transfer time < 120 min.

(200 mg aspirin + 600 mg clopidogrel) or
(200 mg aspirin + 180 mg ticagrelor) or
(200 mg aspirin + 60 mg prasugrel)
+
unfractionated heparin (hemodynamic room)
70-100 IU/Kg IV (maximum 5,000 IU)

**CLINICAL** | **STENT** | **SURGICAL**

AFTER TENECTEPLASE AND TRANSFER DELAY, MAINTAIN

- 100 mg/day aspirin + 75 mg/day clopidogrel + 1mg/kg enoxaparin 12/12h (1 mg/kg/day if ClCr < 30 ml/min.) until Coronary Angiography or until hospital discharge or until the 8th day if still hospitalized.
- Prasugrel: contraindicated: previous CVA/TIA > 75 years.
  Weight ≤ 60 kg = 5 mg/day (special cases)

NEJM 2017;376:2053-64

Annex 3.

SOCESP

## ACUTE CORONARY SYNDROME WITH ST-SEGMENT ELEVATION

PROJECT INFARCTION SOCESP

## CHECKLIST FORM

| IDENTIFICATION | | |
|---|---|---|
| Name: | | Age: |
| Weight (kg): | Height (cm): | |
| Admission: | Date: | Time: |
| Onset of symptoms: | Date: | Time: |

## REPERFUSION THERAPY

| INCLUSION CRITERIA | | | |
|---|---|---|---|
| ☐ Onset symptoms ≤ 12h | | | |
| ☐ Onset symptoms > 12h (if pain or signs of ischemia persist) | | | |
| ☐ ST elevation (J point) ≥ 1 mm (≥ 2 contiguous derivations) | | | |
| ☐ In $V_2$-$V_3$ derivations, consider ST elevation:<br>- Men: ≥ 2,5mm < 40 anos<br>≥ 2,0mm ≥ 40 anos<br>- Women: ≥ 1,5mm | | ☐ ST elevation V7-V9 ≥ 0.5 mm = dorsal infarction (verify ST depression $V_1$-$V_2$)<br>☐ ST elevation V2R-V4R = RV infarction<br>☐ LBBB or new RBBB | |
| **ECG DIAGNOSIS** | | | |
| ☐ Anterior ($V_1$-$V_4$) | | ☐ Dorsal ($V_7$-$V_9$) | |
| ☐ Extended anterior ($V_1$-$V_6$) | | ☐ RV ($V_3$R-$V_4$R) | |
| ☐ Inferior ($D_2$,$D_3$,$aV_F$) | | ☐ Inferior-dorsal ($D_2$, $D_3$, $aV_F$) + ($V_7$-$V_9$) | |
| ☐ Lateral ($D_1$-$aV_L$) ($V_5$-$V_6$) | | ☐ Inferior-lateral-dorsal | |

## A. CENTER WITHOUT HEMODYNAMIC LAB AND WITH TRANSFER TIME > 120 min. = FIBRINOLYTIC AGENT

| CONTRAINDICATIONS | | | |
|---|---|---|---|
| **ABSOLUTE** | | **RELATIVE** | |
| Prior hemorrhage CNS | | SBP > 180 and/or DBP 11 mmHg* | |
| CNS neoplasm (primary or metastatic) | | Prolonged or traumatic CPR | |
| CNS structural lesion | | Transient ischemic attack < 6 months | |
| Ischemic cerebrovascular accident < 6 months | | Major surgery < 21 days | |
| CNS surgery < 2 months | | Endocarditis | |
| Craniocerebral and/or face trauma < 30 days | | Pregnancy, abortion, postpartum < 7 days | |
| Active bleeding (except menstruation) | | Cocaine: prefer primary angioplasty | |
| Coagulopathies | | Oral anticoagulants | |
| Aortic dissection | | Advanced liver disease | |
| Gastrointestinal bleeding < 30 days | | Active peptic ulcer | |
| Non-compressible puncture site < 24 h (liver, kidneys, lower back) | | *No response to antihypertensive drugs | |

Annex 4.

| ADMINISTER FIBRINOLYSIS KIT (up to 10 min. after ECG) | | | |
|---|---|---|---|
| MEDICATION (only one fibrinolytic option) | | Date | Time |
| 1. 200 mg aspirin oral route (chewable) | | | |
| 2. clopidogrel oral route (adjusted for age)<br>• < 75 years = 300 mg<br>• ≥ 75 years = 75 mg | | | |
| 3. enoxaparin (adjusted for age)<br>• < 75 years = 30 mg IV + 1 mg/kg 12/12h SC<br>• ≥ 75 years = 0.75 mg SC 12/12h | | | |
| 4. ALTEPLASE IV (adjusted for weight)<br>15 mg bolus + 0.75 mg/kg (up to 50 mg) in 30 min. + 0.50 mg/kg (up to 35 mg) in 60 min. | | | |
| 5. tenecteplase IV bolus (adjusted for weight and age)<br>Attention: ≥ 75 years – administer half the total dose<br>• < 50 Kg = 30mg = 6mL<br>• 60 - 69Kg = 35mg = 7mL<br>• 70 - 79Kg = 40mg = 8mL<br>• 80 - 89Kg = 45mg = 9mL<br>• ≥ 90Kg = 50mg = 10mL | | | |

| TRANSFER PATIENT IMMEDIATELY TO REFERRAL CENTER | | | |
|---|---|---|---|
| ECG 60-90 min. after beginning fibrinolytic treatment | | Date | Time |
| • **ST elevation resolution ≥ 50%?** (perform angioplasty in 2-24h) | | | |
| • **ST elevation resolution > 50%?** (immediate angioplasty = rescue = URGENT CARE) | | | |



## B. CENTER WITH HEMODYNAMIC LAB OR TRANSFER TIME ≤ 120 min. = PRIMARY ANGIOPLASTY

| ADMINISTER THERAPY KIT (up to 10 min. after ECG) | | | |
|---|---|---|---|
| TWO ANTIPLATELET AGENTS + UNFRACTIONATED HEPARIN | | Date | Time |
| 1. 200 mg aspirin + 600 mg clopidogrel or | | | |
| 2. 200 mg aspirin + 180 mg ticagrelor or | | | |
| 3. 200 mg aspirin + 60 mg prasugrel* | | | |
| 4. unfractionated heparin (hemodynamic room)<br>70-100 IU/Kg IV (maximum 5000 IU) | | | |
| • Patient with elevated hemorrhage risk: prefer clopidogrel<br>* Prasugrel – contraindicated: ≥ 75 years, progress. ICVA/TIA. Weight ≤ 60kg = 5 mg (whenever necessary) | | | |

**IMMEDIATE ANGIOPLASTY**

Date: Doctor Nurse

Annex 5.

SOCESP

**ACUTE CORONARY SYNDROME WITH ST-SEGMENT ELEVATION**

**PROJECT INFARCTION SOCESP**

**CHECKLIST FORM**

| IDENTIFICATION | | |
|---|---|---|
| Name: | | Age: |
| Weight (kg): | Height (cm): | |
| Admission: | Date: | Time: |
| Onset of symptoms: | Date: | Time: |

| TRANSFER INDICATION | |
|---|---|
| 1. PRIMARY ANGIOPLASTY (symptoms < 12h) | |
| 2. PRIMARY ANGIOPLASTY (symptoms ≥ 12h, persistent pain or persistent signs of ischemia) | |
| 3. ANGIOPLASTY AFTER THROMBOLYSIS (resolution ≥ 50%) – perform in 2-24h | |
| 4. ANGIOPLASTY AFTER THROMBOLYSIS (resolution < 50%) = rescue = **URGENT CARE** | |
| 5. ANGIOPLASTY SPECIAL SITUATIONS (cardiogenic shock, pulmonary congestion, acute mitral regurgitation, complex ventricular arrhythmias, fibrinolytic contraindication) | |
| 6. ELECTIVE CORONARY ANGIOGRAPHY (evolving infarction) | |

| ECG DIAGNOSIS – ST ELEVATION | | | |
|---|---|---|---|
| | | Date | Time |
| 1. Anterior ($V_1$ - $V_4$) | | | |
| 2. Extended anterior ($V_1$-$V_6$) | | | |
| 3. Inferior ($D_2$, $D_3$, $aV_F$) | | | |
| 4. Lateral ($D_1$ - $aV_L$) ($V_5$ - $V_6$) | | | |
| 5. Dorsal ($V_7$ – $V_9$) | | | |
| 6. Right ventricle ($V_3R$-$V_4R$) | | | |

| CLINICAL CONDITIONS | | | |
|---|---|---|---|
| BP (mmHg): | HR (beats/min.) | RR (breaths/min.) | T(ºC): |
| KILLIP-KIMBALL *Class*: I | II | III | IV |

Annex 6.

## ADMINISTERED DRUGS

| A. FIBRINOLYSIS KIT | | | | Date | Time |
|---|---|---|---|---|---|
| **1. 200 mg aspirin oral route (chewable)** | | | | | |
| **2. clopidogrel oral route** | | | | | |
| < 75 years = 300 mg = 4 tablets | | | | | |
| ≥ 75 years = 75 mg = 1 tablet | | | | | |
| **3. Enoxaparin** | | | | | |
| < 75 years = 30 mg IV + 1mg/kg 12/12h SC | | | | | |
| ≥ 75 years = 0.75 mg SC 12/12h | | | | | |
| **4. tenecteplase* IV bolus (adjusted for weight and age)** | | | | | |
| < 50 Kg | 30mg | 6 ml | | | |
| 60 – 69 Kg | 35mg | 7 ml | | | |
| 70 – 79 Kg | 40mg | 8 ml | | | |
| 80 – 89 Kg | 45mg | 9 ml | | | |
| ≥ 90 Kg | 50mg | 10 ml | | | |
| *tenecteplase – (syringe = 40 mg or 50 mg = 8 or 10 ml)<br>Attention: ≥ 75 years = administer half of total dose | | | | | |
| **5. alteplase IV (adjusted for weight)**<br>**15 mg bolus + 0.75 mg/kg (up to 50 mg) in 30 min. +**<br>**0.50 mg/kg (up to 35 mg) in 60 min.** | | | | | |

| B. PRIMARY ANGIOPLASTY KIT | | Date | Time |
|---|---|---|---|
| **1. 200 mg aspirin + 600 mg clopidogrel or** | | | |
| **2. 200 mg aspirin + 180 mg ticagrelor or** | | | |
| **3. 200 mg aspirin + 60 mg prasugrel +** | | | |
| **4. unfractionated heparin (hemodynamic room):**<br>**70-100 IU/kg IV (maximum 5000 IU** | | | |

| DRUGS-DEVICES | | Date | Time |
|---|---|---|---|
| • **dopamine, dobutamine, norepinephrine, amiodarone, lidocaine**<br>• **CPR, temporary pacemaker, invasive mechanical ventilation** | | | |

**Date:** **Doctor** **Nurse**