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Review Article—Special issue: Thrombosis

## Acute myocardial infarction and acute stroke: What are the differences? Focus on reperfusion therapy

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## ABSTRACT

This review compares acute myocardial infarction and acute stroke— their similarities and differences. The focus is given on reperfusion therapy: pharmacologic, mechanical or combined. The key trials and metaanalyses are described.

The published data on iv. thrombolysis show, that even among a subgroup of patients treated within 90 min from stroke onset the trend to lower mortality is not significant and in all other subgroups (i.e. treated after >90 min) there is a trend towards increased mortality with thrombolytic treatment.

The data on combined therapy demonstrate, that there is no benefit from facilitated intervention (iv. thrombolysis followed by ia. thrombolysis ± catheter intervention) over iv. thrombolysis alone in acute stroke. This is very similar to the situation in acute myocardial infarction 25 years ago (intracoronary thrombolysis was not superior to intravenous thrombolysis) or more recently (facilitated PCI was not shown to be superior in several trials).

The latest generation of stent retrievers is able to recanalize >70% of occluded intracranial arteries—approximately twice more compared to thrombolysis. However, it is not yet known whether this translates to better clinical outcomes. The sufficient data on clinical outcomes after primary catheter-based thrombectomy (without thrombolysis) are still missing and trials comparing iv. thrombolysis versus primary catheter-based thrombectomy are urgently needed.

The future trials in acute stroke may follow the way paved by acute myocardial infarction trials. If such trials would demonstrate superiority of catheter-based thrombectomy, we can face in future similar revolution in acute stroke treatment as we have been facing in acute MI treatment in the past years.

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## Contents

1. Introduction . . . . . 112
2. Similarities and differences between acute stroke and acute myocardial infarction . . . . . 112

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3. Reperfusion therapy . . . . . 112  
 4. Intravenous thrombolysis . . . . . 113  
 5. Intra-arterial thrombolysis . . . . . 115  
 6. Catheter-based thrombectomy (CBT) . . . . . 115  
 7. Future: how to improve acute stroke outcomes? . . . . . 116  
 Acknowledgements . . . . . 116  
 References . . . . . 116

**1. Introduction**

Acute myocardial infarction and acute stroke are two single most frequent causes of death or severe permanent disability worldwide. 20 years ago both these acute disorders caused extremely high mortality—between 20% and 30% among unselected hospital admissions. While cardiologists succeeded to decrease the in-hospital mortality of unselected acute myocardial infarction to current cca 5–8% during the last 20 years, mortality of acute stroke remained largely unchanged. The dramatic fall of mortality due to acute myocardial infarction was enabled by the introduction of reperfusion therapy: initially thrombolysis and later primary percutaneous coronary intervention (p-PCI). Specifically, the introduction of STEMI networks (effective regional cooperation between emergency medical services, local community hospitals and a tertiary cardiac center) contributed to one of the major breakthroughs in medicine changing a deadly disease into a treatable one. Many cardiologists worldwide (after having fully developed STEMI networks in their regions) are increasingly interested in acute stroke treatment. The interventional treatment of acute stroke requires effective cooperation between several medical specialties. This short review was prepared jointly by one cardiologist, one radiologist and three neurologists and deals with similarities and differences between the two diseases.

**2. Similarities and differences between acute stroke and acute myocardial infarction**

Table 1 shows the key similarities between these two illnesses and Table 2 the main differences. The pathophysiology of acute myocardial infarction and acute ischemic stroke is in principle similar: acute thrombotic occlusion of an artery causes ischemic necrosis of the tissue perfused by that artery. However,

there is a critically important difference in the speed of necrosis development and permanent function loss. While left ventricular (LV) function can be fully restored even after 2–4 h of extensive ischemia and partial LV function recovery takes place even after 12 h of myocardial ischemia, the full recovery of all cerebral functions after moderate—large stroke is rather rare.

The etiology of acute myocardial infarction is rather uniform. Our previously published data showed, that cca 2% of patients admitted for suspected ST segment elevation acute myocardial infarction (STEMI) may have other condition mimicking an infarction [1] and that cca 7% of STEMI patients (mostly heavy smokers) do not have visible atherosclerosis but rather “pure” thrombosis in an angiographically normal coronary artery [2]. Thus over 90% of STEMI patients have the same cause of their infarction: atherosclerotic plaque rupture with superimposed in-situ arterial thrombosis. On the other hand, the etiology of acute ischemic stroke is variable: thromboembolus from the heart (e.g. in atrial fibrillation), paradoxical embolus from the venous system (via atrial septal defect or foramen ovale patens), “arteriogenic” embolus (from aorta or carotid artery), plaque rupture with in-situ thrombosis (similar to myocardial infarction), lacunar (most likely caused by a small artery occlusion, not detectable by current angiographic techniques), cryptogenic (no cause revealed), etc.

**3. Reperfusion therapy**

In the United States during 2009, only 4.5% of ischemic strokes were treated by iv. thrombolysis [3]. Why only a very small proportion of acute stroke patients receives reperfusion therapy when such therapy is used nearly for all patients with acute myocardial infarction? The reasons are listed in Table 3 and Fig. 1.

There are approximately 40,000 hospital admissions for stroke or TIA per year in the Czech Republic (10.5 million

**Table 1 – Similarities between acute myocardial infarction and acute ischemic stroke.**

	<i>Acute myocardial infarction</i>	<i>Acute ischemic stroke</i>
Pathophysiology	Arterial occlusion+ischemic necrosis	Arterial occlusion+ischemic necrosis
Clinical picture	Acute onset	Acute onset
Prognosis	High mortality (if untreated)	High mortality (if untreated)
Effective treatment	Reperfusion therapy	Reperfusion therapy
Thrombolytic treatment	Early reperfusion achieved in <50% of treated patients	Early reperfusion achieved in <50% of treated patients
	Bleeding complications may be fatal	Bleeding complications may be fatal
	Early reocclusion is frequent	Early reocclusion is frequent
Pharmaco-invasive treatment (thrombolysis+mechanical intervention)	Does not offer superior results to either method if performed alone	Does not offer superior results to either method if performed alone
Catheter-based thrombectomy	Clearly established as the most effective therapy.	Emerging as the most effective therapy

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