European Heart Journal
Acute Cardiovascular Care
EUROPEAN SOCIETY OF CARDIOLOGY®

Original scientific paper

European Heart Journal: Acute Cardiovascular Care
2017, Vol. 6(3) 232–243

DOI: 10.1177/2048872615626656
journals.sagepub.com/home/acc
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Fibrinolytic therapy in hospitals without percutaneous coronary intervention capabilities in China from 2001 to 2011: China PEACE-retrospective AMI study

Jing Li[1], Xi Li[1], Joseph S Ross[2,3,4,5], Qing Wang[1], Yongfei Wang[2,6], Nihar R Desai[2,6], Xiao Xu[2,7], Sudhakar V Nuti[2], Frederick A Masoudi[8], John A Spertus[9], Harlan M Krumholz[2,4,5,6], Lixin Jiang[1], for the China PEACE Collaborative Group

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Li J, Li X, Ross JS, Wang Q, Wang Y, Desai NR, Xu X, Nuti SV, Masoudi FA, Spertus JA, Krumholz HM, Jiang L; China PEACE Collaborative Group.

Abstract

Background: Fibrinolytic therapy is the primary reperfusion strategy for ST-segment elevation myocardial infarction in China, and yet little is known about the quality of care regarding its use and whether it has changed over time. This issue is particularly important in hospitals without the capacity for cardiovascular intervention.

Methods: Using a sequential cross-sectional study with two-stage random sampling in 2001, 2006, and 2011, we characterized the use, timing, type and dose of fibrinolytic therapy in a nationally representative sample of patients with ST-segment elevation myocardial infarction admitted to hospitals without the ability to perform percutaneous coronary intervention.

Results: We identified 5306 patients; 2812 (53.0%) were admitted within 12 hours of symptom onset, of whom 2463 (87.6%) were ideal candidates for fibrinolytic therapy. The weighted proportion of ideal candidates receiving fibrinolytic therapy was 45.8% in 2001, 50.0% in 2006, and 53.0% in 2011 (P_{trend}=0.0042). There were no regional differences in fibrinolytic therapy use. Almost all ideal patients (95.1%) were treated after admission to the hospital rather than in the emergency department. Median admission to needle time was 35 minutes (interquartile range 10–82) in 2011, which did not improve from 2006. Under dosing was common. Urokinase, with little evidence of efficacy, was used in 90.2% of patients.

Conclusions: Over the past decade in China, the potential benefits of fibrinolytic therapy were compromised by underuse, patient and hospital delays, underdosing and the predominant use of urokinase, an agent for which there is little clinical evidence. There are ample opportunities for improvement.

Table 1. Bivariate analysis of characteristics associated with patients receiving fibrinolytic therapy among ideal candidates for fibrinolytic therapy

Characteristics	No. of patients with characteristic	No. of patients receiving fibrinolytic therapy (%)	*P* value
All ideal patients	2463	1218 (49.5)	
Demographics			
Age, years			<0.001
<55	607	378 (62.3)	
55–64	606	352 (58.1)	
65–74	738	359 (48.6)	
⩾75	512	129 (25.2)	
Gender			<0.001
Male	1790	962 (53.7)	
Female	673	256 (38.0)	
Cardiovascular risk factor			
Prior hypertension			0.14
No	1474	747 (50.7)	
Yes	989	471 (47.6)	
Prior diabetes			0.28
No	2210	1101 (49.8)	
Yes	253	117 (46.2)	
Currently smoking			<0.001
No	1672	739 (44.2)	
Yes	791	479 (60.6)	
Medical history			
Ischemic stroke >1 year			0.14
No	2331	1161 (49.8)	
Yes	132	57 (43.2)	
Coronary heart disease			<0.001
No	1959	1010 (51.6)	
Yes	504	208 (41.3)	
Myocardial infarction			<0.001
No	2254	1145 (50.8)	
Yes	209	73 (34.9)	
Chronic lung diseases			<0.001
No	2374	1189 (50.1)	
Yes	89	29 (32.6)	

Table 1. Continued

Characteristics	No. of patients with characteristic	No. of patients receiving fibrinolytic therapy (%)	*P* value
Time from symptom onset to admission, hours			0.0012
<3	1097	641 (58.4)	
3–5.9	795	402 (50.6)	
6–12	571	175 (30.6)	
Clinical characteristic at admission			
Chest discomfort			<0.001
No	165	38 (23.0)	
Yes	2298	1180 (51.3)	
Cardiac arrest			0.52
No	2436	1203 (49.4)	
Yes	27	15 (55.6)	
Cardiogenic shock			0.60
No	2256	1112 (49.3)	
Yes	207	106 (51.2)	
Heart rate >100 beats/min			<0.001
No	2193	1127 (51.4)	
Yes	270	91 (33.7)	
SBP ⩾180 mmHg or DBP ⩾110 mmHg			0.21
No	2247	1120 (49.8)	
Yes	216	98 (45.4)	
Infarct location			<0.001
Anterior	1156	596 (51.6)	
Non-anterior	955	523 (54.8)	
Uncertain	352	99 (28.1)	
Economic-geographical region			0.16
Eastern	1183	582 (49.2)	
Central	734	348 (47.4)	
Western	546	288 (52.7)	
Rural/urban			0.87
Rural	1749	863 (49.3)	
Urban	714	355 (49.7)	
Year			0.14
2001	618	285 (46.1)	
2006	818	408 (49.9)	
2011	1027	525 (51.1)	

SBP: systolic blood pressure; DBP: diastolic blood pressure.

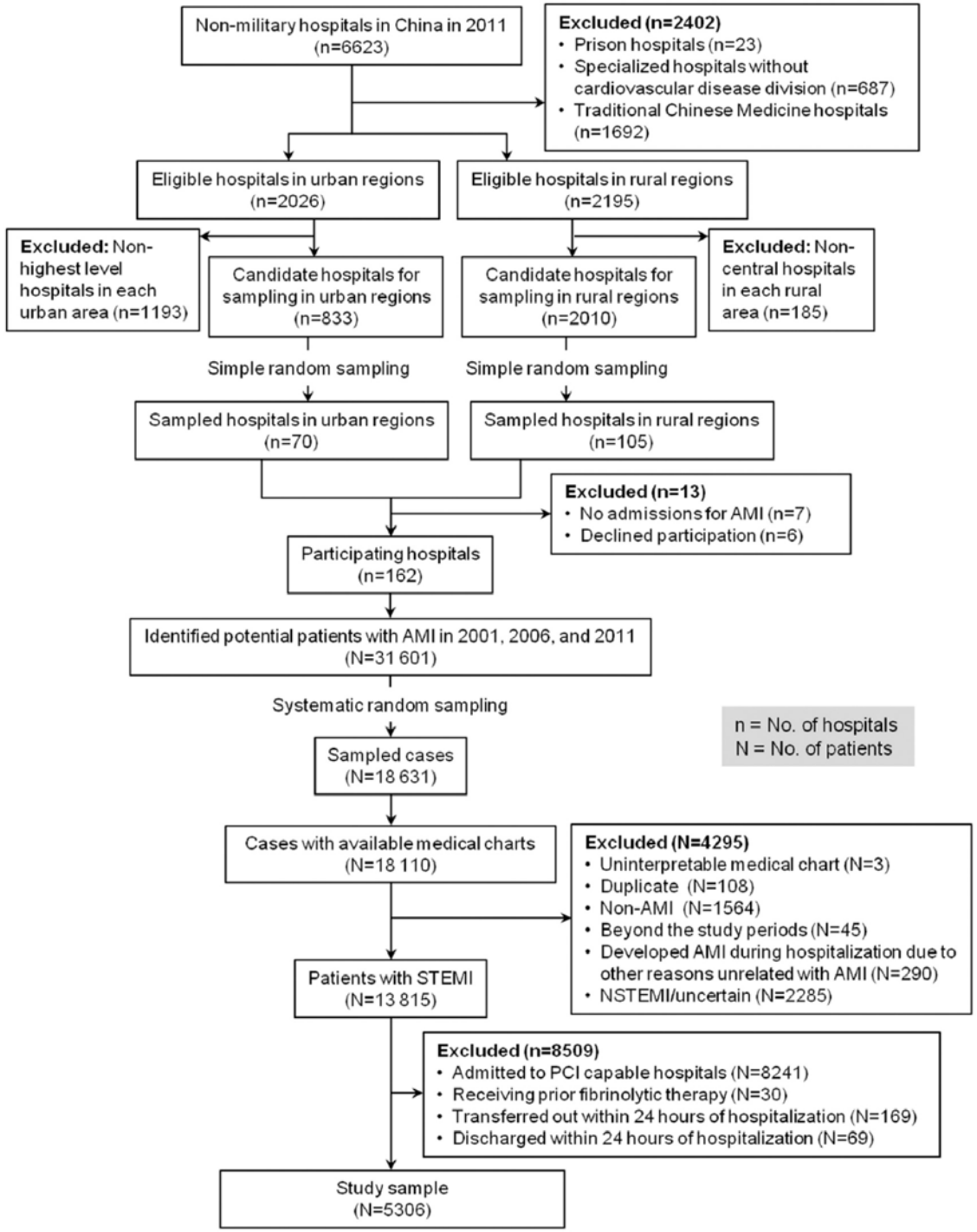

Figure 1. The random sampling and patient profile.
AMI: acute myocardial infarction; STEMI: ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention.

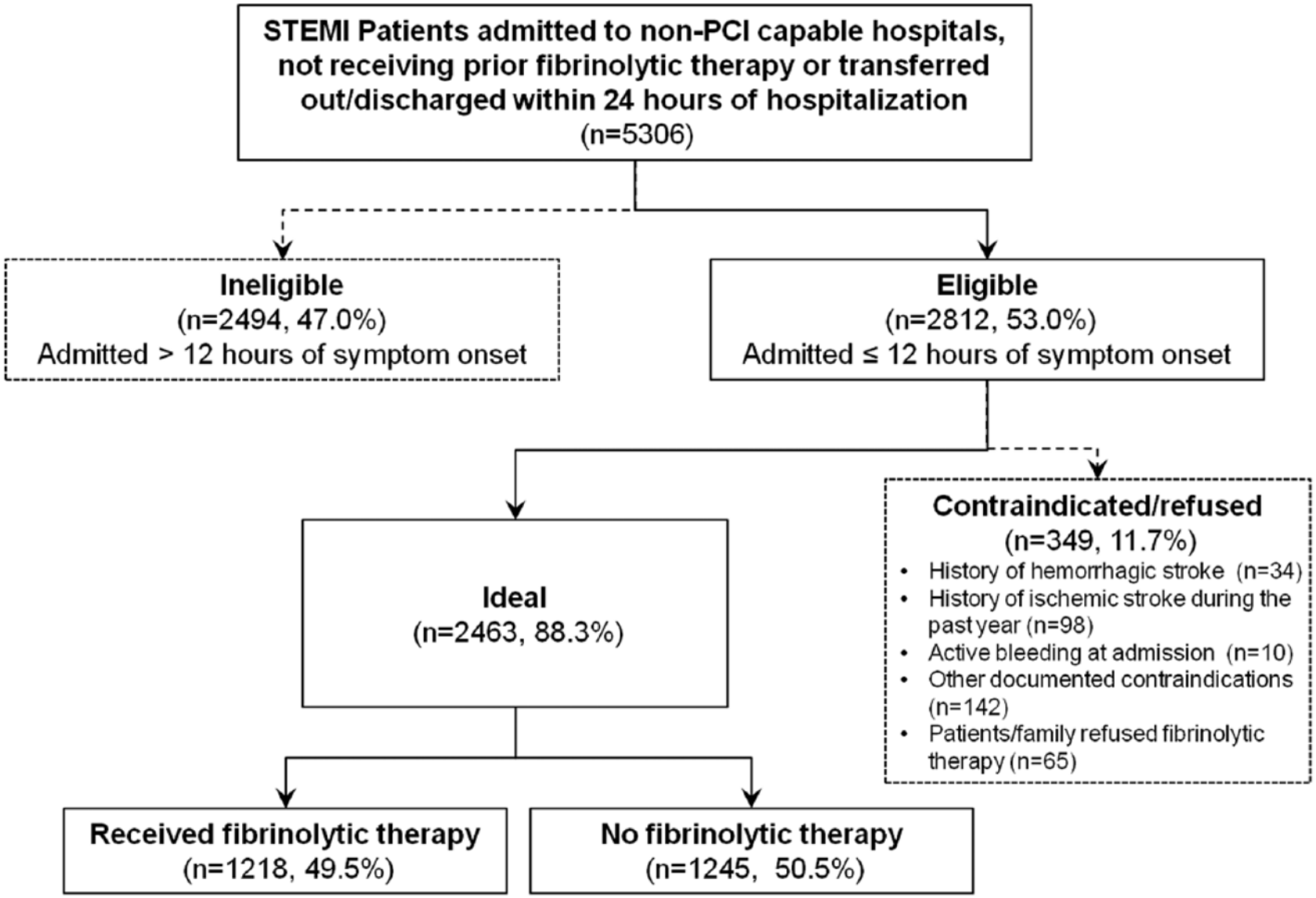

Figure 2. Study sample profile.
STEMI: ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention.

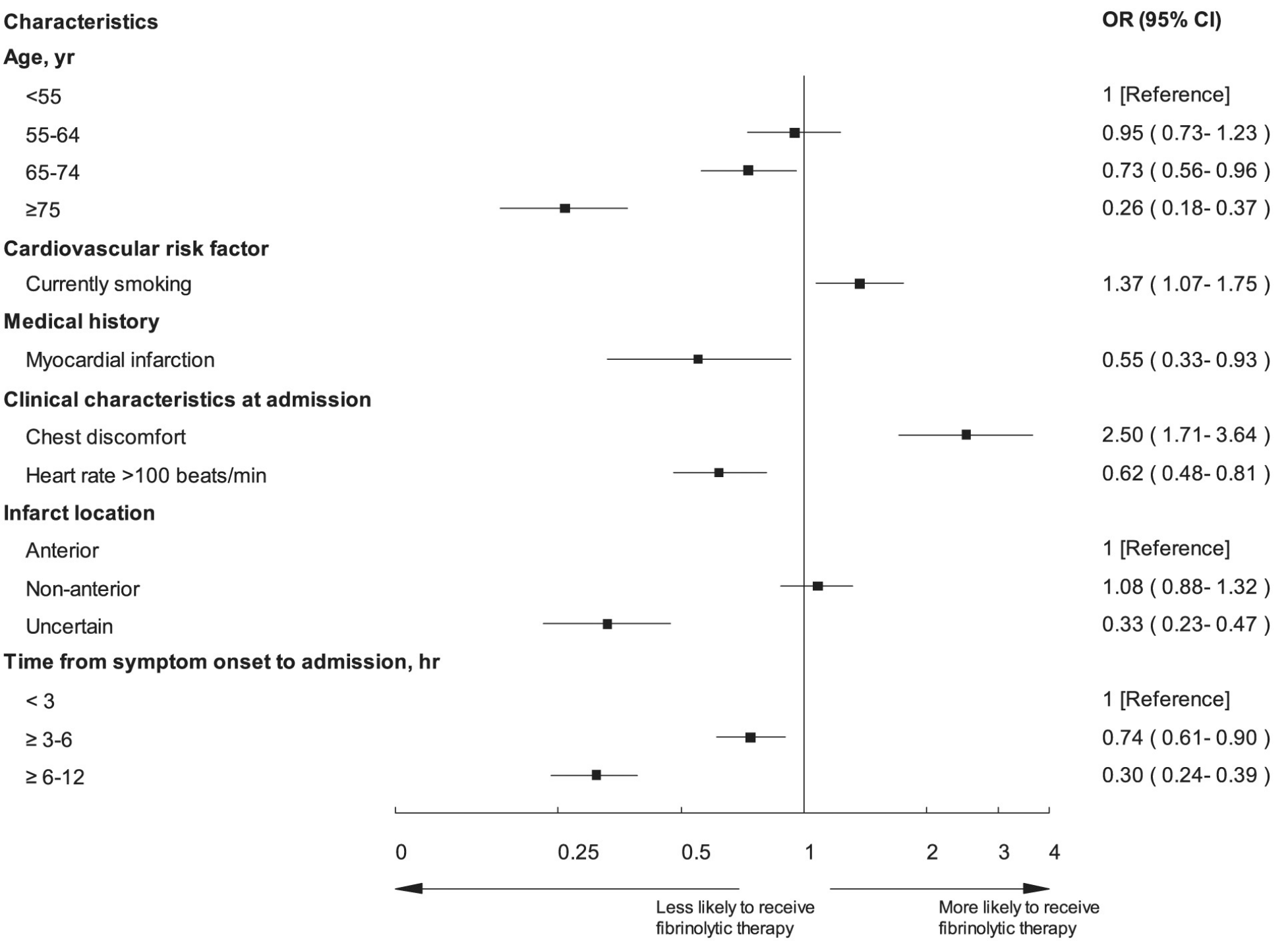

Figure 3. Factors associated with the use of fibrinolytic therapy in multivariable model.

Variables having significant association with the usage of fibrinolytic therapy are shown along the vertical axis. The strength of effect is shown along the horizontal axis with the vertical line demarking an odds ratio (OR) of 1 (i.e. no association); estimates to the right (i.e. >1) are associated with greater likelihood of using fibrinolytic therapy, while those to the left (i.e. <1) indicate association with reduced likelihood of using fibrinolytic therapy. Each square represents the point estimate of the effect of that variable in the model, while the line shows the 95% confidence interval (CI). We adjusted for age, gender, prior hypertension, prior diabetes, currently smoking, prior ischemic stroke, prior coronary heart disease, prior myocardial infarction, cardiogenic shock at presentation, chest discomfort at presentation, symptom onset to admission time, systolic blood pressure, heart rate, infarct location, economic-geographical region, rural/urban region and year.

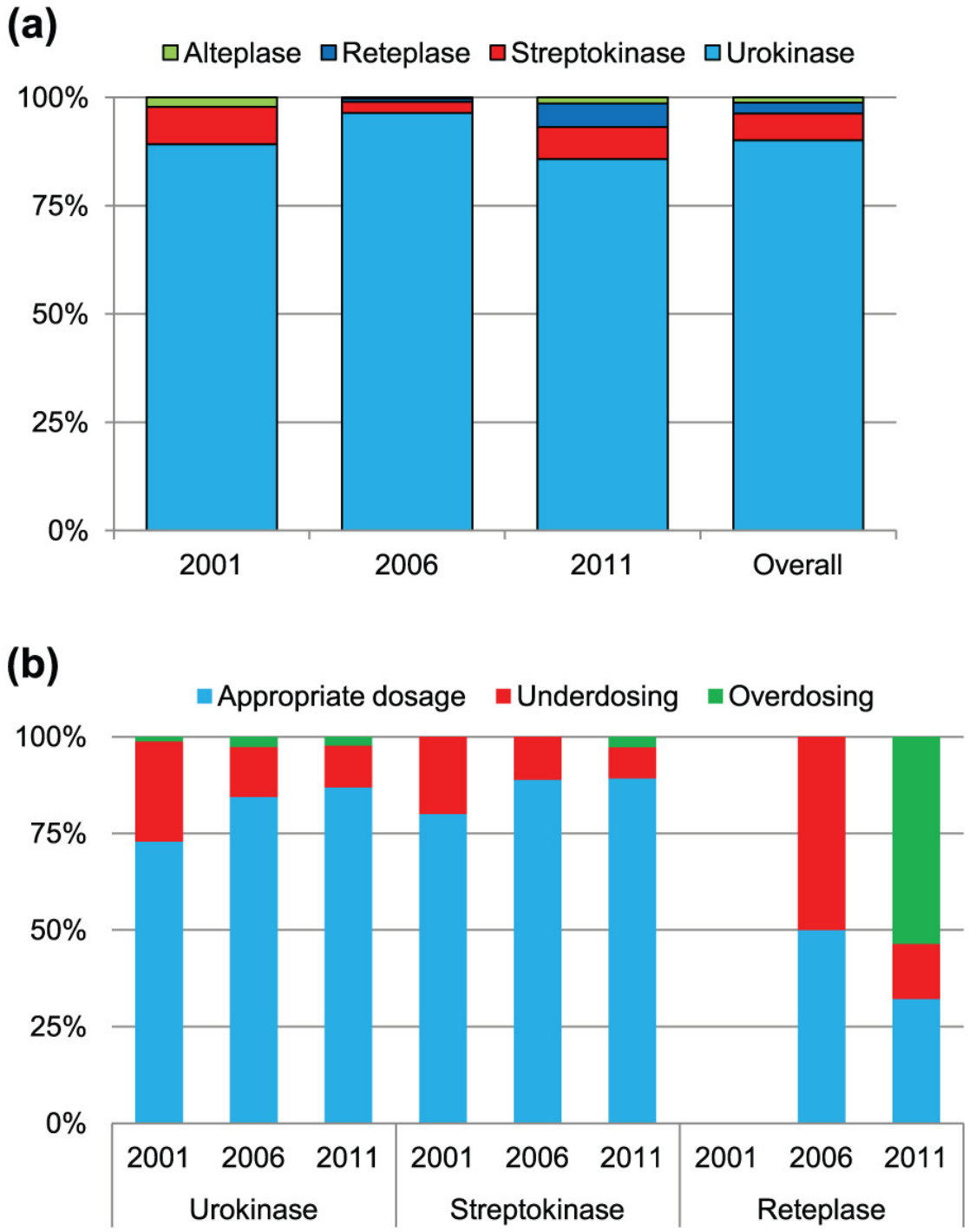

Figure 4. Type (a) and dosage (b) of fibrinolytic agents. No patient received reteplase in 2001. Only four patients received alteplase with dosage available, so alteplase is not shown in this figure.

Table 2. Association of fibrinolytic therapy with in-hospital outcomes among ideal candidates for fibrinolytic therapy.

Outcomes	Fibrinolytic recipient (*n*=1218) No. (%)	Non-recipient (*n*=1245) No. (%)	Unadjusted OR (95% CI)	Adjusted 1[a] OR (95% CI)	Adjusted 2[b] OR (95% CI)
Death	76 (6.2)	138 (11.1)	0.53 (0.41–0.70)	0.64 (0.47–0.88)	0.85 (0.62–1.17)
Death or treatment withdrawal	105 (8.6)	179 (14.4)	0.56 (0.44–0.71)	0.74 (0.56–0.99)	0.93 (0.69–1.26)
Composite Complications	225 (18.5)	284 (22.8)	0.77 (0.62–0.95)	0.98 (0.77–1.27)	1.13 (0.87–1.47)

Composite complications: death, treatment withdrawal due to a terminal status, re-infarction, cardiogenic shock, ischemic stroke or congestive heart failure.

[a]Adjusted for age, gender, prior hypertension, prior diabetes, currently smoking, prior ischemic stroke, prior coronary heart disease, prior myocardial infarction, prior chronic lung disease, cardiogenic shock at presentation, chest discomfort at presentation, symptom onset to admission time, systolic blood pressure, heart rate, infarct location, economic-geographical region, rural/urban region and year.

[b]Adjusted for age, gender, prior hypertension, prior diabetes, currently smoking, prior ischemic stroke, prior coronary heart disease, prior myocardial infarction, prior chronic lung disease, cardiogenic shock at presentation, chest discomfort at presentation, symptom onset to admission time, systolic blood pressure, heart rate, infarct location, economic-geographical region, rural/urban region, year, heparin within 24 hours, aspirin within 24 hours and clopidogrel within 24 hours.

Conclusion

- In China, we found significant underuse and suboptimal administration of fibrinolytic therapy among patients with STEMI admitted to non-PCI-capable hospitals, which provide care for the majority of people in China, especially in rural areas.
- This may undermine the potential benefit of this therapy for patients treated in facilities without advanced technology or access to specialized care.
- In addition, there was little improvement over the past decade.
- These findings highlight the need for a national quality improvement initiative with a clear focus on fibrinolytic therapy in order to achieve its promise fully.
- Our findings raise significant concerns about the underutilization of practical, life-saving, evidence-based therapeutic strategies for STEMI in resource-poor settings around the world.