Critical Pathways in the Emergency Department Improve Treatment Modalities for Patients with ST-Elevation Myocardial Infarction in a European Hospital

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Summary

Background: The use of protocols for patients with ST-elevation myocardial infarction (MI) is growing, but no definite conclusion regarding the value of critical pathways in Europe has been drawn.

Hypothesis: The aim of this study was to investigate the impact of critical pathway on processes of care and outcome for patients presenting to the emergency department (ED) of a large urban European hospital because of possible ST-elevation MI.

Methods: Critical pathways for management of acute chest pain at our ED were developed in 1998 and have been revised every year. Accordingly, the records of all patients referred in 1997 to the ED because of chest pain (before pathway implementation) and in 2001 (after last pathway revision) were reviewed. An ST-elevation MI was diagnosed at ED in 520 of 5,066 (10.3%) patients with chest pain in 1997, and in 452 of 4,843 (9.3%) patients with chest pain in 2001. Patients were managed according to the ED cardiologists' decisions in 1997, whereas they entered the pathways for ST-elevation MI in 2001, with predefined criteria for diagnosis, thrombolysis, percutaneous coronary intervention, and admission to the coronary care unit.

Results: Comparison of treatment modalities disclosed that more patients were given thrombolysis in 1997 (49 vs. 16%,

$p < 0.05$), whereas in 2001 more patients were sent to primary angioplasty (63 vs. 11%, $p < 0.05$). Also in 2001, patients more often received aspirin (90 vs. 61%, $p < 0.05$) and intravenous beta blockers (60 vs. 35%, $p < 0.05$) soon after arrival at the ED. Comparison between 1997 and 2001 revealed that admission rates to the coronary care unit (69 vs. 78%, NS) and cardiac wards were similar (19 vs. 10%, NS). Conversely, compared with 1997, patients hospitalized in 2001 had a shorter length of stay (12 ± 5 vs. 18 ± 6 days, $p < 0.05$), as well as fewer major adverse coronary events (21 vs. 30%, $p < 0.05$) and lower all-cause in-hospital mortality (12 vs. 20%, $p < 0.05$). The quality of care indicators improved with time, as door-to-electrocardiogram interval (10 ± 6 vs. 19 ± 9 min, $p < 0.05$), door-to-needle time (25 ± 10 vs. 35 ± 10 min, $p < 0.05$), and door-to-balloon interval (70 ± 15 vs. 99 ± 20 min, $p < 0.05$) were shorter in 2001 than in 1997.

Conclusions: A critical pathway for ST-elevation MI at the ED increases the use of evidence-based treatment strategies and improves outcome and quality of care of patients presenting to a European hospital because of acute chest pain.

Key words: chest pain, critical pathways, emergency department, acute myocardial infarction

Introduction

The adaptation of an industrial management tool—the critical pathway method—to health care delivery is increasingly proposed as a successful strategy to reduce length of stay and improve the quality of care in patients with cardiac diseases.¹ For this reason, critical pathways have become a popular strategy in the U.S., particularly for the management of patients with acute coronary syndromes and ST-elevation myocardial infarction (MI).^{2–4} In Europe, conversely, critical pathways are not applied extensively and no previous study has verified their effectiveness in patients with chest pain.

The present study aimed to investigate the impact of critical pathways on processes of care and outcome for patients presenting to the Emergency Department (ED) because of possible ST-elevation MI in a large urban European hospital.

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Methods

We reviewed the records of 5,066 patients who presented to the ED with acute chest pain in 1997, and of 4,843 patients with chest pain admitted to the ED in 2001. On arrival at the ED, all patients underwent rapid clinical evaluation, including electrocardiography (ECG).

In 1997, patients were then managed by the ED cardiologist on duty, who made all further triage, diagnostic, and therapeutic decisions, including choice of assigned unit, laboratory testing, drug therapy, diagnostic testing and procedures, length of stay at the ED, and timing of hospital discharge.

In 2001, all patients entered the ED's critical pathways for management of acute chest pain, with predefined criteria for diagnosis (i.e., ST- vs. non-ST-elevation MI), thrombolysis (i.e., checklist of indications and contraindications), percutaneous coronary intervention (i.e., list of absolute and relative indications), and admission to the coronary care unit (i.e., checklist of clinical criteria indicating high, moderate, or low risk). Pathways were developed in 1998 and revised every year to include the most recently published guidelines. Patients with ECG changes consistent with acute ischemia, positive findings on serial determinations of cardiac markers, pathologic features at echocardiography, or any other condition requiring hospital admission are transferred to the coronary care unit or directly to the catheterization laboratory for further evaluation and treatment. Structured collection of data is performed with the use of an ad hoc checklist order form.

The following clinical indicators of quality assurance were evaluated in this study: (1) receiving fibrinolytic therapy within the National Heart Attack Alert Program goal of 30 min after hospital arrival;⁵ (2) receiving primary angioplasty within the American College of Cardiology/American Heart Association national practice guidelines recommendation of 90 min after hospital arrival.⁶

Continuous variables are expressed as mean $\pm$ standard deviation (SD). Nonparametric data were compared by a Mann-Whitney test. The level of significance was set at $p < 0.05$.

Results

An ST-elevation MI was diagnosed at the ED in 520 of 5,066 (10.3%) patients with chest pain in 1997, and in 452 of 4,843 (9.3%) patients with chest pain in 2001.

The two study populations (Table I) were comparable with regard to age, gender, type of ST-elevation MI, and prehospital delay. Comparison of treatment modalities disclosed that more patients underwent thrombolysis in 1997 (49 vs. 16%, $p < 0.05$), whereas in 2001 more patients were sent to primary angioplasty (63 vs. 11%, $p < 0.05$). In 2001, patients also more often received aspirin (90 vs. 61%, $p < 0.05$) and beta blockers (60 vs. 35%, $p < 0.05$) soon after arrival at the ED. Comparison between 1997 and 2001 revealed similar admission rates to the coronary care unit (69 vs. 78%, NS) and cardiac wards (19 vs. 10%, NS).

It is noteworthy that patients hospitalized in 2001 had fewer major adverse coronary events (21 vs. 30%, $p < 0.05$), lower all-cause in-hospital mortality (12 vs. 20%, $p < 0.05$), and shorter length of stay (12 ± 5 vs. 18 ± 6 days, $p < 0.05$) than those evaluated in 1997.

The quality of care indicators improved with time, as door-to-ECG interval (10 ± 6 vs. 19 ± 9 min, $p < 0.05$), door-to-thrombolysis time (35 ± 10 vs. 45 ± 10 min, $p < 0.05$), and door-to-balloon interval (70 ± 15 vs. 99 ± 20 min, $p < 0.05$) were shorter in 2001 than in 1997. Of those treated with thrombolysis, drug therapy began within 30 min in 79 patients in 1997 and in 41 patients in 2001 (31 vs. 57%, $p < 0.05$). Of those treated with primary angioplasty, the procedure was performed within 90 min in 17 patients in 1997 and in 156 patients in 2001 (29 vs. 65%, $p < 0.05$).

Discussion

The results of the present study demonstrate that use of ED critical pathways for chest pain may improve the management of patients with ST-elevation MI in a large urban European hospital, similar to what has been previously observed in the U.S.¹⁻³

With critical pathway implementation, we observed an increase in the number of patients with ST-elevation MI who underwent primary angioplasty. In addition, the use of acetylsalicylic acid and beta blockers increased significantly by 29 and 25%, respectively. Our findings are consistent with those obtained in Chicago, where the introduction of pathways for acute coronary syndromes was associated with a more frequent use of aspirin and beta blockers, as well as earlier application of coronary angiography with less frequent recurrent angina, infarction, and death.⁴

Our results regarding quality of care indicators provide support for enhancement of patient care based on the implementation of critical pathways. It is noteworthy that when entered into critical pathways, patients had a 49% greater chance of receiving fibrinolytic therapy within the National Heart Attack Alert Program goal of 30 min after hospital arrival,⁵ and a 66% greater chance of receiving primary angioplasty within the recommendation of 90 min after hospital arrival.⁶ These findings are similar to those previously obtained in U.S. hospitals by Cannon *et al.*³ and by Caputo *et al.*,⁷ thus indicating that establishment of a critical pathway for ST-elevation MI also allows European EDs to improve quality of care by decreasing time to treatment.

Limitations

We acknowledge that ours was not a prospective and randomized study. Another limitation that effects the difference between 1997 and 2001 is the selection of reperfusion strategy, as primary angioplasty was incorporated in our critical pathway as a more prominent treatment option in 2001 according to updated guidelines. However, it is important to note that in-

TABLE I Comparison between the two study populations

	1997 (n = 520)	2001 (n = 452)	p Value
Clinical characteristics			
Age (years)	51 ± 17	54 ± 19	NS
Males/females	313/207	258/194	NS
Anterior STEMI (%)	203 (39)	199 (44)	NS
Lateral STEMI (%)	104 (20)	81 (18)	NS
Inferior STEMI (%)	213 (41)	172 (38)	NS
Pre hospital features			
Onset of symptoms-arrival to ED (min)	151 ± 54	132 ± 63	NS
Arrival < 3 h from onset of symptoms	172 (33)	208 (46)	NS
Treatment modalities			
Thrombolysis (%)	255 (49)	72 (16)	<0.05
Primary PCI (%)	57 (11)	240 (53)	<0.05
No reperfusion (%)	208 (40)	140 (31)	NS
Aspirin (%)	317 (61)	407 (90)	<0.05
Heparin (%)	177 (34)	181 (40)	NS
Beta blocker IV (%)	182 (35)	271 (60)	<0.05
Treatment modalities			
Admission to coronary care unit (%)	359 (69)	352 (78)	NS
Admission to cardiac ward (%)	99 (19)	45 (10)	NS
Quality-of-care indicators			
Door-to-ECG interval (min)	19 ± 9	10 ± 6	<0.05
Door-to-ECG interval < 10 min (%)	369 (71)	366 (81)	NS
Door-to-thrombolysis (min)	45 ± 20	35 ± 22	NS
Door-to-thrombolysis < 30 min (%)	79 (31)	41 (57)	NS
Door-to-balloon (min)	99 ± 20	70 ± 15	<0.05
Door-to-balloon < 90 min (%)	17 (29)	156 (65)	<0.05
Outcome			
Overall MACE (%)	156 (30)	95 (21)	<0.05
In-hospital mortality (%)	104 (20)	54 (12)	<0.05
CABG (%)	166 (32)	77 (17)	NS
Recurrance of MI (%)	36 (7)	23 (5)	NS
Length of hospital stay (days)	18 ± 6	12 ± 5	NS

Abbreviations: CABG = coronary artery bypass graft, ED = Emergency Department, MACE = major adverse coronary events, IV = intravenous, MI = myocardial infarction, STEMI = ST-elevation acute myocardial infarction, PCI = percutaneous coronary intervention, ECG = electrocardiogram, NS = not significant.

roduction of critical pathways resulted in an improvement of both door-to-thrombolysis and door-to-balloon times.

Conclusion

The development of critical pathways at the ED increases the use of evidence-based treatment strategies and improves outcome and quality of care of patients with ST-elevation MI presenting to a large European hospital because of acute chest pain. Our study, therefore, indicates that similar to what has been observed previously in American hospitals, a more widespread development of critical pathways for acute chest pain is mandatory in Europe, not only to reduce costs but also to improve quality of care of patients with ST-elevation MI.

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