

Comparing the Process of Quality of Care for Managing Acute ST-Segment Elevation Myocardial Infarction Between Headquarter and Branch Hospitals

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Background: Based on internationally accepted guidelines, management of acute ST-segment elevation myocardial infarction (STEMI) must follow a discrete discipline and can be used as an indicator for monitoring quality of care (QC). The objective of this study was to apply a standardized measurement to evaluate QC for STEMI between headquarter and a branch hospital so as to maintain QC during expansion of a health care organization in Taiwan.

Methods: All the patients presented to National Taiwan University Hospital Yun-Lin Branch (NTUH-YL) with STEMI between 1st December 2004 and 30th November 2006 were reviewed retrospectively. Overall one-year mortality rate and ten parameters related to the process of QC for STEMI were retrieved and compared to those from National Taiwan University Hospital (NTUH).

Results: During the period, 74 patients manifested with STEMI to NTUH-YL, with mean age 59+/-12 in men and 69+/-11 in women. One-year overall mortality was 8~10% in both hospitals. In comparing the performance, NTUH-YL was superior in β -blocker use and lipid management, and inferior in early aspirin use. Other parameters such as reperfusion rate, complication rates, use of angiotensin-converting enzyme inhibitors, and long-term aspirin use were comparable between headquarter and branch hospitals.

Conclusion: Less-experienced cardiologists can perform equally well and even better than more-experienced doctors if principles of evidence-based medicine are applied. Measurements in the process domain can be used to compare and to ensure quality of care across different health providers.

Key Words: Aspirin • HMG-CoA • Myocardial infarction • Percutaneous transluminal coronary angioplasty • Quality of health care • Statins

INTRODUCTION

Judging quality of care (QC) in a health care providing system must take into account several aspects: (1) structural attributes of the settings in which care occurs, (2) the processes of care, and (3) the outcomes of care.¹ Measurement of QC has provided guides for promoting better health care. Acute ST-segment elevation myocardial infarction (STEMI) is well suited for QC evaluation and hospital accreditation because it is a common diagnosis that has caused a great amount of morbidity and

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mortality and accrues high expenditure.²

Previous work by Chang and Lin has demonstrated a high level of QC for STEMI provided by National Taiwan University Hospital (NTUH).³ As compared to the data from the National Registry of Myocardial Infarction 4 (NRMI-4) trial in the United States, the primary coronary intervention team of NTUH has achieved an extraordinarily high reperfusion rate (83.2% in NTUH vs. $54.5 \pm 13.3\%$ in USA) within the 12-hour golden time.^{4,5} It has also been shown that the use of aspirin and angiotensin-converting enzyme inhibitors (ACE-I)/angiotensin receptor blockers (ARB) were comparable to US standards, but β -blocker use and lipid management were suboptimal.^{3,6,7}

While the headquarter hospital provided promising results in managing patients with STEMI, it was of interest to illustrate whether the same QC could be maintained in a rural branch where resources were relatively scarce and health providers were less experienced.⁸ We sought to compare the major items in the process of QC performance for the patients admitted with STEMI, and aimed to use this approach as a standardized measure and new model for future QC assurance and hospital accreditation in Taiwan.

METHODS

Clinical setting

National Taiwan University Hospital (NTUH), founded in 1895, is one of the largest and most modern ones in the southeastern Asia. With more than 5,000 employees serving approximately 2,000 inpatients and 7,000 outpatients daily, the hospital remains the most renowned medical center in Taiwan.⁹ National Taiwan University Hospital Yun-Lin Branch (NTUH-YL), located in an agricultural county in the middle of Taiwan, was established in 1976 and became part of NTUH in April 2004.¹⁰ Since then, NTUH has dispatched young attending staff, fellows, residents, and interns to participate in health care, education, and research in the Yun-Lin area. The Cardiovascular Center of NTUH-YL was founded on 15 November 2004, initially with 7 cardiologists, 4 cardiovascular surgeons, and 1 pediatric cardiologist. A coronary intervention team with a fully equipped catheterization laboratory has been preparatory

around the clock for primary transluminal coronary angioplasty.¹¹

Data and sampling

All the patients presented to NTUH-YL with STEMI between 1 December 2004 and 30 November 2006 were reviewed retrospectively. One cardiologist who was not involved in the care of these patients was asked to review all the medical records, including paper charts at the emergency room (ER), paper and electronic records, and laboratory data. Cases with confirmed STEMI were included in further analysis.

Measures

All the clinical information was reviewed by the cardiologist, and narration was interpreted and coded in an EXCEL spread sheet. Ten major parameters in the process of QC for STEMI were documented:

1. The proportion of early aspirin use in the patients without contraindications
2. The proportion of early β -blocker use in the patients without contraindications
3. The proportion of reperfusion within 12 hours
4. The proportion of cardiovascular and non-cardiovascular complications during admission
5. The proportion of ACE-I use just after discharge in the patients with depressed LV function but no contraindications
6. The proportion of aspirin use after discharge in the patients without contraindications
7. The proportion of β -blocker use after discharge in the patients without contraindications
8. The proportion of LDL measurement during admission
9. The proportion of statin use during admission
10. The proportion of reaching LDL goal one year after admission

Patients with contraindications to any of the above measures were excluded from the denominator during proportion calculation. Contraindications to aspirin were previous intracranial hemorrhage, active upper gastrointestinal bleeding or other non-compressible bleeding, and aspirin allergy. Contraindications to β -blockers included symptomatic bradycardia, hypotension (systolic blood pressure < 90 mmHg), decompensated lung edema, and active wheezing. Contraindications to ACEI/ARB

included hyperkalemia (serum potassium level greater than 5.3 mEq/L), severe azotemia (creatinine level greater than 3.5 mg/dl), hypotension (systolic blood pressure < 90 mmHg), or intolerable side effects such as cough and angioedema. QC measures derived from NTUH-YL were compared to those from NTUH³ and the standard of care for STEMI in the United States of America.^{4,5}

Statistics

All the QC measures were expressed as percentage and 95 percent confidence interval (95% CI). Categorical data were compared with χ^2 . Fisher exact test was applied if the case number was small.

RESULTS

In the period between 1 December 2004 and 30 November 2006, 74 patients presented to NTUH-YL with STEMI. There were 58 men (mean age 59+/-12) and 16 women (mean age 69+/-11). The percentages of Killip classification I to IV were 61%, 14%, 5%, and 20%, respectively (Table 1). There was no significant difference in sex and age between NTUH-YL and NTUH. The proportions of cardiogenic shock (Killip IV) were comparable (20% vs. 21%).

In comparing quality performance to NTUH, NTUH-YL was superior in β -blocker use at ER, β -blocker use at discharge, LDL measurement at admission, and statin

use at admission, but was inferior in aspirin use at ER (Table 2). Other parameters, including reperfusion rate within 12 hours, ACE-I or ARB use at discharge, aspirin at discharge, and LDL goal at one year, were non-statistically higher at NTUH-YL. Complication rates were comparable at both hospitals.

Six patients missed the 12-hour golden time due to personal delay before they visited NTUH-YL. Of those within the golden time, 67 patients underwent primary percutaneous transluminal coronary angioplasty (PTCA) and none of them received thrombolytic therapy. One pa-

Table 1. Comparison of demographic data in patients with ST-segment elevation myocardial infarction between NTUH-YL and NTUH

	NTUH-YL	NTUH	P-value
Case number	74	281	
Duration	12/1/2004 11/30/2006	1/1/2002 12/31/2004	
Gender			0.626
Male	58	227	
Female	16	54	
Age (years)			
Male	59 ± 12	61 ± 14	0.158
Female	69 ± 11	73 ± 12	0.189
Killip classification			0.029
Killip I	61%	53%	
Killip II	14%	12%	
Killip III	5%	14%	
Killip IV	20%	21%	

Table 2. Parameters of quality of care in NTUH-YL and NTUH (NS: not significant)

	NTUH-YL		NTUH		p-value	Comparison
	%	95% CI	%	95% CI		
Aspirin use at ER	83	74-92	94	91-97	< 0.006	YL worse
β -blocker use at ER	5		0		0.013	YL better
Reperfusion within 12 hour	91	84-97	85	81-89	0.26	NS
Complication rate	28	18-39	26	21-31	0.39	NS
ACE-I or ARB at discharge	90	70-100	85	73-97	0.571	NS
Aspirin at discharge	98	95-100	94	91-97	0.125	NS
β -blocker at discharge	93	86-100	73	67-80	0.002	YL better
LDL measurement at admission	92	85-98	68	62-74	< 0.001	YL better
Statin use at admission	46	34-57	31	25-37	0.003	YL better
LDL goal reached at one year						
< 100 mg/dL	58	30-86	46	40-50	0.625	NS
< 70 mg/dL	25	1-50	18	13-22	0.158	NS

tient died before PTCA. Early reperfusion rate was virtually 100%. Complications included tachyarrhythmia (14.9%), bleeding (6.8%), bradyarrhythmia (5.4%), cardiogenic shock (5.4%), and lung edema (1.4%). One-year overall mortality was 8.1% (5 cardiovascular death and one death due to post-cardiotomy wound infection), comparable to that of NTUH (10.3%, 95% CI: 6.8~13.1%). Among the mortality cases in NTUH, 21 were due to cardiovascular death, 5 to probable cardiovascular death (infection, renal failure, and other complications after STEMI), and 3 to non-cardiovascular events. Cardiovascular case-fatality rates were 7.4% (CV causes) and 9.2% (CV and probable CV causes) in NTUH, and 6.7% in NTUH-YL (CV causes).

DISCUSSION

Sufficient evidence has supported that measuring, reporting, and improving the process of managing STEMI can improve patients' outcome.¹² In our previous study using this standardized evaluation, we found that NTUH provided a high early reperfusion rate, low complication rate and case fatality, and adequate long-term management for patients with STEMI, as compared to the nationwide performance in the United States.³ The present study has further shown that a widely accepted method for QC measurement can be successfully applied across different hospitals in Taiwan.

The National Registry of Myocardial Infarction 4 (NRM-4) trial evaluated the quality of care to 53,417 patients in 962 US hospitals, and reported the performance on process measures (54.5 ± 13.3% for timely reperfusion, 86.4 ± 7.8% for aspirin at admission, 79.6 ± 15.3% for aspirin at discharge, 78.0 ± 12.4% for β-blocker at admission, 75.8 ± 15.6% for β-blocker at discharge, and 70.7 ± 10.8% for ACE-I at discharge, and 86.7% for lipid-lowering agents at discharge).⁵ Compared to the current standard of care, NTUH-YL has achieved a very high early reperfusion rate at +2.71 standard deviations (SD) above the US average. Aspirin use at ER and at discharge were located at -0.45 SD and +1.23 SD, respectively. ACE-I/ARB and β-blocker at discharge were slightly above US average (+1.79 SD and +1.08 SD, respectively). Statin use at discharge and lipid control after discharge were about

only half of the US average. The practice pattern was exactly the same as what has been seen at NTUH, i.e., an extraordinary response to primary PTCA, average level of subsequent medical treatment, and suboptimal lipid management.³

NTUH-YL has a newly developed cardiovascular center, in which the cardiologists are relatively young and less experienced. However, their QC measures outperformed those of NTUH in β-blocker use and lipid management. Using the cases in NTUH as a historical control (from 2002 to 2004), the young cardiologists in NTUH-YL (from 2004 to 2006) had more time to be exposed to current concepts of evidence-based management for STEMI. Additionally, care for patients with STEMI in NTUH was multiple-staged. Interventionists performed primary PTCA but residents were responsible for most of the in-hospital management. The continuous care by certified cardiologists from ER to discharge in NTUH-YL has been demonstrated to better comply with current guidelines and recommendations.

On the other hand, the weaker item of NTUH-YL was aspirin use at ER. As the medical chart was reviewed, it was found that certain doctors at ER called the catheterization team before they gave 160-325 mg aspirin to the patient. Although prompt response of the primary PTCA team is advantageous, a proper initial management at ER should be reinforced. In addition, programs aiming toward promoting other QC measures, such as smoking and risk factor counseling, vaccination, and cardiovascular rehabilitation, were still under development.¹² This study has shown that the concept of complying with clinical guidelines and recommendations¹³ should involve an integrated cooperation among ER specialists, cardiologists, and rehabilitation experts.

Application of an internationally standardized evaluation method in headquarter and branch hospitals has suggested a new model for accrediting hospitals in Taiwan. Traditionally used parameters such as provider experience, doctor-to-patient number, and hospital size, belong to the structure domain and are independent of patient outcome. On the other hand, a hospital should be qualified for accreditation if patient records can be faithfully retrieved from a charting system or clinical information system and all the QC measures in the process of managing STEMI can achieve an acceptable level. This method is more objective and less prone to bias resulting

from tedious paperwork and human manipulation.

Limitations

Since the data from NTUH and NTUH-YL were retrieved from medical charts and clinical information system, information concerning door-to-needle or door-to-balloon time, which was not a QC measure in NRMI-4, was not available. In terms of quality of care measures, the parameter that matters is the overall mortality at one year, medication attainment rate, and laboratory test goals. Background clinical demography and specific occurrences of MACES (repeated infarction, revascularization, etc.) were of less interest and not summarized in detail.

CONCLUSION

With establishing branch hospitals having become a trend in Taiwan, it is always debated whether QC can be adequately maintained. Measurements in the process domain can be used to compare and ensure QC across different health providers. Less-experienced cardiologists can perform equally well and even better than more-experienced doctors if the principles of evidence-based medicine are to be applied. This objective approach for evaluating QC should be incorporated and generalized into the quality control and hospital accreditation system in Taiwan.

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