Factors related to the in-hospital course of acute coronary syndrome

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ABSTRACT

Introduction: The advent of new invasive coronary intervention strategies has led to a worldwide reduction in morbidity and in-hospital mortality from acute coronary syndrome. However, these indicators have had some variations in the Provincial Department of Cardiology of Sancti Spiritus.

Objective: To determine the clinical and epidemiological factors associated with in-hospital course of patients admitted with this diagnosis.

Method: An observational, descriptive, and retrospective research was carried out at the Department of Cardiology at Camilo Cienfuegos General Provincial Hospital in 2011. The sample consisted of 363 patients admitted with some clinical forms of acute ischemic heart disease. The frequency distribution according to clinical and epidemiological variables were calculated by statistical significance tests (Chi square, logistic regression, beta exponential), which allowed to establish relations with the different variables and mortality.

Results: The most frequent complications were: acute left ventricular dysfunction, ventricular arrhythmias and post-infarction angina. Prior topography infarction, history of previous infarction, hypertension and smoking were the variables that related the most with mechanical complications and recurrent stroke. The longest demurrage was motivated by postinfarction angina, reinfarction and cardiogenic shock.

Conclusions: There was a decrease in hospital mortality from acute coronary syndrome in 2011 although there was a high incidence of mechanical and arrhythmic complications which motivated a longer stay at the Department of Cardiology.

Key words: Acute coronary syndrome, Coronary artery disease, Prognosis, Cardiovascular mortality

Factores relacionados con la evolución intrahospitalaria del síndrome coronario agudo

RESUMEN

Introducción: El advenimiento de nuevas estrategias invasivas de intervención coronaria ha propiciado una disminución de la morbilidad y la mortalidad intrahospitalaria por síndrome coronario agudo a nivel mundial. Sin embargo, estos indicadores han tenido sus variaciones en el Servicio Provincial de Cardiología de Sancti Spíritus.

Objetivo: Determinar los factores clínicos-epidemiológicos relacionados con la evolución intrahospitalaria de los pacientes ingresados con este diagnóstico.

Método: Se realizó una investigación observacional, descriptiva, retrospectiva en el Servicio de Cardiología del Hospital Provincial General Camilo Cienfuegos de Sancti Spíritus durante el año 2011. La muestra estuvo conformada por los 363 pacientes que ingresaron con algunas de las formas clínicas agudas de cardiopatía isquémica. Se calculó la distribución de frecuencias según variables clínicas y epidemiológicas y se aplicaron pruebas de significación estadística (Chi cuadrado, Regresión logística, Exponencial de beta), que permitieron establecer relaciones con las distintas variables y la mortalidad.

Resultados: Las complicaciones que se presentaron con mayor frecuencia fueron: disfunción ventricular izquierda aguda, arritmias ventriculares y angina postinfarto. Los infartos de topografía anterior, el antecedente de infarto previo, la hipertensión arterial y el hábito de fumar, fueron las variables más relacionadas con las complicaciones mecánicas y el infarto recidivante. La mayor sobreestadía estuvo motivada por la angina postinfarto, el reinfarto y el *shock* cardiogénico.

Conclusiones: Existió una disminución de la mortalidad hospitalaria por síndrome coronario agudo en el año 2011 aunque hubo una elevada incidencia de complicaciones mecánicas y arrítmicas que motivaron una mayor estadía en el Servicio de Cardiología.

Palabras clave: Síndrome coronario agudo, Cardiopatía isquémica, Factores pronósticos, Mortalidad cardiovascular

INTRODUCTION

Acute coronary syndrome (ACS) in its different clinical presentations shares a common pathophysiological substrate, which consist in the rupture or erosion of the atherosclerotic plaque, with varying degrees of thrombotic complications and distal embolization[1]. As it is a condition that endangers the patient's life, criteria for risk stratification have been developed to allow timely decisions for the pharmacological treatment and coronary revascularization strategies according to each patient[2].

Cuba has managed to build a complex and comprehensive health system that increases the life expectancy of the population, and this is a scenario with potential for an epidemic of ischemic heart disease. Acute myocardial infarction (AMI) is the most feared form of presentation due to the high rate of complications and lethal episodes it may cause. However, there has been a downward trend in mortality rate from this cause due to the application of invasive coronary intervention strategies, and a greater emphasis on preventive secondary measures[3,4].

The situation at the Camilo Cienfuegos Provincial Hospital differs from this national trend, which was reflected in an increased lethality of AMI from 2007.

The highest figure was recorded in 2009 when it reached 20%. This percentage is higher than the quality standard for such institutions, which is less than 15.9%.

After the diagnosis, it is necessary to know the prognosis of any disease[4]. The prediction of factors that are related to the course of a given disease is applicable to ACS, at a time where there is, at hospital level, a significant increase in the rates of hospital morbidity and mortality from this cause.

This reasoning led to the proposal to conduct a study in order to determine the clinical and epidemiological factors related to the in-hospital course of patients admitted with ACS, identify predictors of complications and death, and determine the causes of a longer stay at the Coronary Care Unit.

METHOD

An observational, descriptive, retrospective study was conducted in order to identify those clinical and epidemiological factors that are predictors of unfavorable in-hospital outcome. Patients admitted to the Cardiology Department of the Camilo Cienfuegos General Provincial Hospital in Sancti Spiritus, Cuba, from Janu-

ary to December 2011 were selected.

The sample consisted of 363 patients admitted to the hospital during this period with a diagnosis of ACS.

Data collection
An instrument was devised with the variables of interest, which were incorporated into a data collection sheet.

Statistical analysis
A database was devised with the statistical processing program SPSS, version 11.5, on a PC with Windows XP operating system.

Frequency distribution of patients with ACS was calculated; and they were distributed by age and sex, diagnosis at discharge and average stay in the ward. Patients with cardiovascular complications underwent statistical significance tests for the comparison of proportions (chi square of Pearson) in search of an alleged association between qualitative variables. Logistic regression was used to determine the relationship between the complications and the quantitative variables.

Differences were considered significant if the value of p for the case of hypothesis docimacy was lower than 0.05, with a significance level of 95%.

The risk of death for each patient and the risk of presenting various complications were calculated using the results of the regression models (the exponential of beta as an expression of relative risk).

Percentages were used as relative frequency measures to summarize the information of qualitative variables. The information of quantitative variables was summarized using the mean and standard deviation.

RESULTS

Of the total of 363 patients admitted to the Cardiology Department, 53.9% were male with a mean age of 66.7 years; and 52.6% had a non-ST-segment elevation acute coronary syndrome (NSTEACS), with a higher diagnosis in the different forms of unstable angina (**Table 1**).

It was noticed that patients with a diagnosis of ST segment elevation myocardial infarction (STEMI) contributed the highest number of deaths with 21 (87.5% of the total), for a case fatality of 5.8%. The overall

Table 1. Characteristics of patients with ACS in the Cardiology Department. Camilo Cienfuegos General Provincial Hospital, 2011.

Variable	Nº	%
Total of patients	363	100
Male	196	53.9
White skin	326	89.9
Mean age*	66.68 ± 12.95	
STEACS	172	47.4
NSTEMI	41	11.3
Unstable angina	150	41.3
Complications	121	33.3
Deceased	24	6.7
Total mean stay*	5.46 ± 2.69	

Source: Database of the Coronary Care Unit.
* $\overline{X}$ ± SD
STEACS, ST-segment elevation acute coronary syndrome; NSTEMI, non-ST segment elevation myocardial infarction

case fatality rate in the department was 6.7%, well below the rates maintained in the period from 2007 to 2010. Also, 33.3% of cases presented various complications and the total average stay was 5.46 days.

When distributing the patients according to their personal medical history and cardiovascular risk factors (**Table 2**) there was a prevalence of hypertensive patients (81.5%; p=0.00), followed by those with a history of ischemic heart disease (62.8%; p=0.00), dyslipidemia (40.2%; 0.08) and smoking (36.1%; p=0.04). There was also a statistically significant association with previous myocardial infarction (p=0.00), obesity (p=0.015) and diabetes mellitus (p=0.04).

With regard to the distribution of patients according to the topography of AMI and the effectiveness of fibrinolytic therapy (**Table 3**), the inferior location of AMI predominated (42.4%), which in turn were those who received more thrombolytic therapy (23.3%) compared to the total of patients admitted for this cause.

When showing the frequency of major complications (**Table 4**) it was evident there was a predominance of acute forms of heart failure (acute pulmonary edema and cardiogenic shock), with values exceeding 13%, followed by ventricular arrhythmias and postin-

Table 2. Distribution of patients according to personal medical history and diagnosis at discharge.

Personal medical history	Diagnosis at discharge (n=363)								p
	STEMI		NSTEMI		Unstable angina		Total		
	Nº	%	Nº	%	Nº	%	Nº	%	
Hypertension	124	34.2	36	9.9	136	37.4	296	81.5	**0.00**
Ischemic heart disease	70	19.3	30	8.3	128	35.2	228	62.8	**0.00**
Dyslipidemia	59	16.3	17	4.6	70	19.3	146	40.2	0.08
Smoking	80	22.0	10	2.7	41	11.4	131	36.1	**0.04**
Previous infarction	25	6.9	10	2.7	63	17.3	98	26.9	**0,00**
Obesity	45	12.4	12	3.3	44	12.1	101	27.8	**0.015**
Diabetes mellitus	40	11.0	8	2.1	44	12.1	92	25.3	**0.04**
Severe valve disease	5	1.4	1	0.3	4	1.1	10	2.7	0.50
SMR	2	0.5	0	0	5	1.4	7	1.9	0.06
Multivessel disease	7	1.9	1	0.3	17	4.6	25	6.9	0.69

STEMI, ST segment elevation myocardial infarction; NSTEMI, non-ST segment elevation myocardial infarction; SMR, surgical myocardial revascularization.

Table 3. Distribution of patients according to the location of infarction, fibrinolytic therapy and its efficacy.

Location of infarction	Nº	%	Thrombolysis						
			Place			Nº	%	Effective	
			EICU	CICU	Area			Nº	%
Inferior	73	42.4	19	7	14	40	23.3	7	8.0
Anterior	50	29.1	9	6	5	20	11.6	1	1.1
Anteroseptal	21	12.2	8	0	2	10	5.8	1	1.1
Extensive anterior	12	6.9	3	3	2	8	4.7	2	2.3
Anterolateral	8	4.7	3	1	1	5	2.9	2	2.3
Lateral	6	3.5	2	1	1	4	2.3	1	1.1
Extended to the right ventricle	2	1.2	0	0	0	0	0	0	0
Total	**172**	**100.0**	**44**	**18**	**25**	**87**	**50.6**	**14**	**15.9**

UCIE, Unidad de Cuidados Intensivos de Emergencia; UCIC, Unidad de Cuidados Intensivos Coronarios.

Table 4. Major complications according to the form of presentation of the ACS.

Complications	STEMI		NSTEMI		Unstable angina		Total		p
	Nº	%	Nº	%	Nº	%	Nº	%	
Acute pulmonary edema	21	5.8	2	0.6	4	1.1	27	7.5	0.000
Cardiogenic shock	20	5.5	1	0.3	0	0	21	5.8	0.000
Ventricular arrhythmias	16	4.4	1	0.3	10	2.8	27	7.5	0.015
Postinfarction angina	13	3.6	0	0	3	0.8	16	4.4	0.000
Reinfarction	7	1.9	0	0	0	0	7	1.9	0.000
AV conduction disorders	9	2.5	0	0	1	0.3	10	2.8	0.018
Deceased	21	5.8	2	0.6	1	0.3	24	6.7	0.040

AV, atrioventricular; STEMI, ST segment elevation myocardial infarction; NSTEMI, non-ST segment elevation myocardial infarction.

Table 5. Predictors of complications and death in patients admitted with ACS.

Predictors	Nº	%	p	Exp (B)
Cardiogenic shock				
Anterior location	8	38.1	0.00	3.6
Diabetes mellitus	4	19.0	0.05	2.2
Smoking	10	47.6	0.04	1.5
Postinfarction angina				
Previous coronary surgery	2	12.5	0.03	2.8
Hyperglycemia	15	93.7	0.03	1.3
Acute pulmonary edema				
Chronic heart failure	20	74.1	0.02	36.2
Previous AMI	6	22.2	0.05	19
Anterior location	20	74.1	0.00	7.3
Reinfarction				
Heart failure	4	57.1	0.02	36
Previous AMI	5	71.4	0.00	20
Death				
Diabetes mellitus	7	29.1	0.005	23
Peripheral vascular disease	2	9.5	0.000	9.2
Cardiogenic shock	11	52.3	0.000	8.1
Acute pulmonary edema	2	9.5	0.002	4.7
AV conduction disorders	3	14.3	0.003	2.6
Hyperglycemia	1	4.2	0.000	2,6
Chronic kidney disease	6	25	0.040	1.2

AMI, acute myocardial infarction; AV, atrioventricular

farction angina, with 7.5% and 4.4% respectively.

There were common predictive factors for acute lung edema and reinfarction (**Table 5**), with a stronger association with previous infarction and chronic forms of heart failure. The anterior AMI was the variable that showed the highest statistical relationship with the occurrence of cardiogenic shock (p=0.00) and acute pulmonary edema (p=0.00). Post-infarction angina was associated with previous coronary surgery (p=0.03) and hyperglycemia in the acute phase (p=0.03); the latter was a factor strongly associated with mortality (p=0.00), also a history of diabetes mellitus (p=0.005), peripheral vascular disease (p=0.000), acute heart failure (pulmonary edema [p=0.002] and shock [p=0.000]), disorders of atrioventricular conduction (p= 0.003) and chronic kidney disease (p=0.04).

Of these complications, postinfarction angina (204 hours), cardiogenic shock (180 hours) and reinfarction (168 hours) were those that motivated a longer stay of patients, which exceeded seven days of hospitalization (**Table 6**).

DISCUSSION

Men have a higher risk of acute ischemic stroke up to 65 years of age, when women have an equal risk as long as the rest of the risk factors are similar. However, the prognosis is worse in females because it presents clinically at older ages, with greater comorbidity, smaller caliber of the coronary vessels, and a higher rate of mortality in the first infarction[5].

There is still an underestimation of AMI patients without ST segment elevation, which could be related to the lack of enzyme markers that are an important mainstay for the diagnosis of this disease. In almost all cases, the diagnosis is done by the clinical and electrical evolution.

High blood pressure is also a risk factor for heart failure, peripheral vascular disease and renal failure, both in men and women. Mortality from ischemic heart disease and stroke increases progressively and linearly from blood pressures as low as 115 mmHg, systolic, and 75 mmHg, diastolic[6]. The effects of hypertension are enhanced when they interact synergistically with other risk factors such as smoking and diabetes mellitus[7].

Dyslipidemia is a major risk factor and it has been

Table 6. Stay and overstay in the ward due to complications of ACS.

Complications	Estadía (horas)			Sobre-estadía
	Mínima	Máxima	Promedio	
Postinfarction angina	168	240	204	70.96
Cardiogenic shock	124	240	180	46.56
Reinfarction	120	216	168	34.56
Hyperglycemia	72	216	144	0.96

demonstrated that the increased levels of total cholesterol is associated with coronary complications, and when it joins with hypertriglyceridemia the cardiovascular risk increases 6 times. Obesity is closely linked to this factor, which is now considered a global epidemic. The analysis of data from the INTERHEART study shows that having abdominal obesity doubles the risk of AMI compared to the control group[8].

It is noteworthy that only 50.6% of patients with STEMI received fibrinolysis, and of these, 15.9% had clinical and electrocardiographic evidence of reperfusion, which is a very low figure, if we take into account that streptokinase is the most accessible fibrinolytic agent in the country. This result was similar to those of Rubiera *et al*[9], in a study conducted in an Comprehensive Diagnostic Center in Venezuela, and to those of Mellado *et al*[10], in an autonomous community of Spain.

The prevalence of in-hospital fibrinolytic agent use differs from international standards that advocate the early use of the drug to shorten the pain-to-needle time, which is vital to save ischemic muscle and prevent complications. Multiple tests demonstrate the benefits of prehospital fibrinolysis in terms of reducing mortality when this treatment is used in the first two hours after the onset of symptoms[11].

The complications that occurred during hospitalization were more frequent in STEMI, which coincides with what has been published worldwide. Cardiogenic shock is the most severe clinical manifestations of acute left ventricular failure and is associated with extensive damage to the ventricular myocardium. The factors that have had a closer relation with this complication are: age, diabetes mellitus, a history of previous myocardial infarction and anterior AMI[11-13]; which have some similarity with the results of this study.

Heart arrhythmias, and especially ventricular arrhythmias, had a much lower frequency than those reported in the literature[12], which could be related to the time of onset in the early hours of the ACS, when the patient has not yet sought medical attention or the assistance is delayed depending on factors of the healthcare network. Therefore, the incidence of this complication is higher the sooner the patients are seen after the beginning of their symptoms[13].

The incidence of postinfarction and reinfarction angina has been declining in those departments with percutaneous coronary intervention, which was still very limited in area where this study was conducted. The factors mostly related to these complications are diabetes mellitus, a history of previous myocardial infarction and various forms of heart failure in the acute phase[14].

In terms of mortality, after the coronary units were created, it was evident that the left ventricular function is an important early determinant of survival. The occurrence of heart failure after AMI is associated with an increased risk of sudden death of cardiac origin[15-17]. Other factors associated with an adverse prognosis include postinfarction angina and reinfarction[18,19].

Special mention deserves hyperglycemia in the acute phase, a very common complication in ACS, and a powerful predictor of mortality in both diabetic and non-diabetics patients[20,21]. In this study, it was a factor related to most in-hospital complications, and the one that better predicted short-term prognosis of large myocardial infarctions.

A longer stay is an indicator that expresses an increase of institutional and social costs if we consider health care expenses, care of chronic patient and premature death (potential years of life lost and loss of labor productivity). There are studies on the cost of illness in the literature, but these should be analyzed in terms of the Cuban health system, based on the socialist character of the Cuban economy[22].

CONCLUSIONS

There was a decrease in hospital mortality for ACS in 2011, with a high incidence of mechanical and arrhythmic complications, which led to a longer stay in the Cardiology Department.

REFERENCES

1. Hamm CW, Bassand JP, Agewall S, Bax J, Boersma E, Bueno H, *et al*. Guía de práctica clínica de la ESC para el manejo del síndrome coronario agudo en pacientes sin elevación persistente del segmento ST. Rev Esp Cardiol. 2012;65:173.e1-e55.
2. Tubaro M, Danchin N, Goldstein P, Filippatos G, Hasin Y, Heras M, *et al*. Tratamiento prehospitalario de los pacientes con IAMCEST. Una declaración

científica del *Working Group Acute Cardiac Care* de la *European Society of Cardiology*. Rev Esp Cardiol. 2012;65:60-70.

3. Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K, *et al*. Heart disease and stroke statistics – 2009 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation. 2009;119:e21-181.

4. Nuñez J, Sanchis J, Núñez E, Bodí V, Mainar L, Miña-na G, *et al*. Insuficiencia cardiaca aguda post-alta hospitalaria tras un síndrome coronario agudo sin elevación del segmento-ST y riesgo de muerte e infarto agudo de miocardio subsiguiente. Rev Esp Cardiol. 2010;63:1035-44.

5. Fox KA, Carruthers KF, Dunbar DR, Graham C, Man-ning JR, De Raedt H, *et al*. Underestimated and under-recognized: the late consequences of acute coronary syndrome (GRACE UK-Belgian Study). Eur Heart J. 2010;31:2755-64.

6. Mancia G, Fagard R, Narkiewicz K, Redón J, Zan-chetti A, Böhm M, *et al*. 2013 ESH/ESC Guidelines for the management of arterial hypertension: the Task Force for the management of arterial hyper-tension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). J Hypertens. 2013;31:1281-357.

7. Mirzaei M, Truswell AS, Taylor R, Leeder SR. Coro-nary heart disease epidemics: not all the same. Heart. 2009;95:740-6.

8. Stone GW, Maehara A, Lansky AJ, De Bruyne B, Cristea E, Mintz GS, *et al*. A prospective natural-history study of coronary atherosclerosis. N Engl J Med. 2011;364:226-35.

9. Rubiera R, Lara A, Ramos NI, Palacio H, Vignier D. Síndrome coronario agudo. Caracterización clínico epidemiológica. A propósito de nuestro primer año. Rev Cubana Med Intens Emergen [Internet]. 2009 [citado 12 Ago 2014];8:1450-61. Disponible en: http://www.bvs.sld.cu/revistas/mie/vol8_3_09/mi e07309.htm

10. Mellado FJ, Rosell F, Ruiz M. Tratamiento extra-hospitalario del infarto agudo de miocardio en Andalucía. Rev Esp Cardiol. 2005;58:1287-93.

11. Kuch B, von Scheidt W, Kling B, Ehmann A, Gres-chik C, Meisinger C. Are there options to prevent early occurring deaths in acute myocardial infarc-tion: Prospective evaluation of all <24 h in-hospital deaths, 2004-2006 – The MONICA/KORA Augsburg Infarction Registry. Cardiology. 2010;116:237-44.

12. Strom M, Wan X, Poelzing S, Ficker E, Rosenbaum DS. Gap junction heterogeneity as mechanism for electrophysiologically distinct properties across the ventricular wall. Am J Physiol Heart Circ Physiol. 2010;298:H787-94.

13. Morrow DA. Cardiovascular risk prediction in pa-tients with stable and unstable coronary heart dis-ease. Circulation. 2010;121:2681-91.

14. León CA. Predicción de la muerte súbita cardíaca post infarto ¿Tenemos otros métodos para prede-cir la muerte súbita cardíaca post infarto agudo de miocardio, además de la fracción de eyección? Insuf Card. 2011;6:144-50.

15. Ochoa LA, González M, Vilches E, Fernández-Britto JE, Araujo RE, en representación de la Sección de Investigación en Muerte Súbita de la Sociedad Cu-bana de Aterosclerosis. Muerte súbita cardiovascu-lar en poblaciones de riesgo. CorSalud [Internet]. 2014 [citado 20 Sep 2014];6:S71-8. Disponible en: http://www.corsalud.sld.cu/suplementos/2014/v6 s1a14/pob-riesgo.html

16. Vigo J. Muerte súbita cardíaca: La importancia de la desfibrilación temprana y la resucitación cardio-pulmonar. CorSalud [Internet]. 2014 [citado 20 Sep 2014];6:S46-59. Disponible en: http://www.corsalud.sld.cu/suplementos/2014/v6 s1a14/rcp.html

17. Orta J. Protocolos de actuación para prevenir la muerte súbita. Experiencia cubana. CorSalud [In-ternet]. 2014 [citado 20 Sep 2014];6:S19 [Resu-men]. Disponible en: http://www.corsalud.sld.cu/suplementos/2014/v6 s1a14/resumenes.html

18. Cordero QM, Ramírez JI, Moreno-Martínez FL, González O. Valor predictivo de algunos modelos de estratificación de riesgo en pacientes con infarto agudo de miocardio con elevación del ST. CorSalud [Internet]. 2013 [citado 20 Sep 2014];5: 57-71. Disponible en: http://www.corsalud.sld.cu/sumario/2013/v5n1a1 3/estratificacion.html

19. Serrano G, Pérez JM, del Pino E. Evolución clínica de pacientes con infarto agudo de miocardio tra-tados con angioplastia primaria. CorSalud [Inter-net]. 2012 [citado 20 Sep 2014];4:157-65. Disponi-ble en:

http://www.corsalud.sld.cu/sumario/2012/v4n3a12/actp.html

20. Lønborg J, Vejlstrup N, Kelbæk H, Nepper-Christensen L, Jørgensen E, Helqvist S, *et al*. Impact of acute hyperglycemia on myocardial infarct size, area at risk, and salvage in patients with STEMI and the association with exenatide treatment: Results from a randomized study. Diabetes. 2014;63:2474-85.

21. León-Aliz E, Moreno-Martínez FL, Pérez-Fernández GA, Vega-Fleites LF, Rabassa-López-Calleja MA. Índice leuco-glucémico como marcador pronóstico de la evolución intrahospitalaria en pacientes con infarto agudo de miocardio con elevación del ST. Clin Invest Arterioscl. 2014;26:167-74.

22. Fernández A, Gálvez AM, Castillo A. Costo institucional del infarto agudo del miocardio en el Instituto de Cardiología y Cirugía Cardiovascular. Rev Cubana Salud Pública [Internet]. 2008 [citado 23 Sep 2014];34:[aprox. 8 p.]. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-34662008000400006