Int J Clin Exp Med 2016;9(8):16621-16628
www.ijcem.com /ISSN:1940-5901/IJCEM0025247

Original Article

Effects of different pre-hospital emergency patterns on the acute coronary syndrome outcome

Min Li, Wei Song

Department of Emergency, Hainan General Hospital, Haikou 570311, China

Received January 30, 2016; Accepted July 10, 2016; Epub August 15, 2016; Published August 30, 2016

Abstract: Objective: To study the comprehensive level and therapeutic effect of ambulance care of patients with acute coronary syndrome (ACS) in China. Methods: A total of 260 cases in 13 ambulance centers were studied. Data were collected based on an epidemiological investigation of the target population. The population-based cross-sectional study used a self-designed questionnaire to investigate the ambulance therapeutic effect of ACS patients. Results: The ambulance distance to drive in directive pattern was shorter when compared with the dependent pattern; the call-response time in directive pattern was shorter when compared with the pre-hospital and dependent patterns. Further, the call-arrival time in directive pattern was longer when compared with the independent and dependent patterns. The analysis of the on-site preliminary therapy evidenced the differences in the establishment of intravenous access, aspirin and nitrate doses, and electrocardiogram ($P < 0.05$) in these four patterns. The total intervention effective rate of ACS was 48.0%, while the rate in directive pattern was 70.0%. Besides, the therapeutic effect of ACS included the pre-hospital pattern (OR = 4.097), the directive pattern (OR = 5.158), nitrate drug (OR = 3.045), and oral dosing (OR = 8.215). Conclusions: The call-arrival time of all the four pre-hospital care patterns proved necessary to compensate for the shortfall created by any of the other patterns. In ACS ambulance intervention, the proper administration of medication, such as aspirin, sedatives analgesic, and nitrates should increase from the low-down level. Except the independent type, the other three types showed no differences in ACS ambulance intervention. The total achieved effective rate of 48% in the ACS ambulance intervention is not enough, and it requires further attention and more efficient implementation of the system.

Keywords: Acute coronary syndrome, pre-hospital emergency, epidemiology

Introduction

The publication of the "2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" [1] marked the worldwide recognition of the pre-hospital emergency treatment programs for acute coronary syndrome (ACS) by the scholars in the emergency field [2]. According to these guidelines, the ACS ambulance intervention can effectively reduce the mortality and pre-hospital survival rates of patients with ACS [3]. Meanwhile, improved workability, standard diagnosis, and treatment process cause minor individual variation in the pre-hospital treatment, eliminate its interference, and influence the other factors affecting the total pre-hospital care in the emergency aid centers [4]. In China, the current pre-hospital emergency medical model can be roughly divided into four patterns: Beijing model (pre-hospital pattern), Shenyang model (independent pattern), Shenzhen model (directive pattern), and Chongqing model (dependent pattern).In China, ambulance care has rapidly developed over the past 20 years. This development led to a series of problems, such as inconsistent ambulance care levels. The implementation of ACS diagnosis and treatment process in the field of national first aid is faulty [5, 6]. This is due to inconsistent ACS patient diagnosis and treatment [7, 8], and delayed or incorrect treatments conducted by the ambulance personnel [9, 10]. Furthermore, the effective assessment of the diagnosis and treatment is scarce [11, 12]. This study intends to reveal the ambulance care status of ACS patients and the factors that influence the effect of ambulance intervention for ACS patients. This study will combine investigations of the national ACS ambulance care as well as a multicenter comparative study of the ambulance intervention effect.

Table 1. Questionnaire of the ambulance intervention effect in ACS

Phase I: Call to response				
1	Name	Age	Sex	No.
2	Phone	Emergency center name	Distance of transportation	Complained of chest pain?
3	Time of receiving patients call		Time of ambulance transportation	
Phase II: Site disposal				
4	Time of arrive at the scene	Pulse	Respiration	Blood pressure
5	Field rescue: monitoring vital signs/establish vein channel/oxygen/aspirin/nitrate drugs/sedative and analgesic/ECG/thrombolysis/other treatment			
6	Correct identification: low risk/moderate risk/high risk			
7	Thrombolytic therapy: indications/contraindications			
8	Triage and transport: conservative treatment in a nearby hospital/thrombolysis in a nearby hospital/PCI in a nearby hospital			
Phase III: Spot to the hospital				
9	Time of leave the scene	Time of arrive at the hospital	Start time of the medication	Name of the receiving hospital
10	Pulse	Respiration	Blood pressure	SaO_2
11	Skin color: normal/pale/cyanosis	Skin temperature: normal/cool	Skin humidity: normal/wet	
12	GCS	Pain (1-10)	Left pupil mm	Right pupil mm
13	History of present illness		Past history	
14	History of drug allergy		Tentative diagnosis	
15	Using medication before arrival Y/N	Drug name	Dose	Route of administration
16	Using medication after arrival Y/N	Drug name	Dose	Route of administration
17	Chest pain after treatment	Relieve Y/N	Aggravate Y/N	No change Y/N
18	Vital signs after treatment	Relieve Y/N	Aggravate Y/N	No change Y/N
19	ECG after treatment	Relieve Y/N	Aggravate Y/N	No change Y/N
20	Cardiac arrest Y/N		Cardiopulmonary resuscitation Y/N	
Phase IV: Emergency room treatment				
21	Time of assessment	Time of be hospitalized	Is the diagnosis consistent with?	
22	Assessment: myocardial injury markers (positive and negative)/electrocardiography (dynamic evolution of positive and negative)/typical ischemic chest pain (with and without)			
23	Diagnosis: unstable angina/NSTEMI/STEMI/exclusion ACS/death/automatic discharge			
24	Treatment: conservative treatment/thrombolysis/PCI/coronary artery bypass grafting			
Phase V: Reported end events				
25	Endpoint events: prehospital death/death in emergency room/serious arrhythmia [1]/heart failure [2]/non cardiovascular disease events [3]/Give up treatment			

Note: [1] frequent ventricular premature beat, ventricular tachycardia, ventricular fibrillation, supraventricular tachycardia, atrial flutter and II - III degree atrioventricular block; [2] NYHA heart function classification increased more than 1 grade; [3] cancer, accidental death, suicide. Required: 1, The recording fill by prehospital doctors out after asking the patients, the questionnaire relates to the patient privacy, If there is no license, no disclosure. 2, Start events for this study: ① with a chief complaint of chest pain; ② dispatcher considered in patients with suspected ACS; ③ prehospital doctor diagnosis of ACS; 3, Exclusion criteria: the ACS patient admitted directly without treatment by prehospital doctor and from lower hospital transfer to higher hospital.

Subjects and methods

Subjects

From October 2009 to March 2010, we investigated 13 units; 7 ambulance centers (Shenyang Emergency Center represents the independent pattern; Beijing Emergency Medical Center represents the pre-hospital pattern; Chongqing Emergency Medical Center, Hefei Municipal Emergency Center, Haikou Emergency Center, and Xining Emergency Center represent the dependent pattern; Shenzhen Emergency Center represents the independent pattern) and 6 emergency network hospitals (Peking University Shenzhen Hospital, The Second People's Hospital of Shenzhen, The People's Hospital of Futian Shenzhen, The People's Hospital of Bao'an Shenzhen, Shenzhen Nanshan People's Hospital, and Shenzhen Luohu People's Hospital) associated with the Shenzhen Emergency Center that represents the directive pattern. We analyzed 272 cases that met the study criteria. Out of these, 260 were effective cases (165 male and 95 female). The male to female ratio was of 1:0.58. There were 30, 65, 99 and 66 patients in independent, pre-hospital, directive and dependent pattern, respectively. There was no significant difference in age, sex, smoking history, body mass index, complicated hypertension, hyperlipidemia, diabetes mellitus and characteristics of coronary artery disease among four groups ($P > 0.05$). This study was conducted in

Table 2. Comparison of ambulance transportation distance and total time interval indexes in four ambulance patterns ($\bar{x} \pm s$)

Type	Ambulance transportation distance (km)	Call response time (sec)	Call arrival time (min)	On-scene care time (min)	Total time interval (min)
Independent	5.9 ± 6.2	43.7 ± 34.5	7.9 ± 3.5	19.4 ± 11.0	37.8 ± 12.4
Pre-hospital	*	65.6 ± 51.7	6.7 ± 3.1	18.8 ± 10.4	42.1 ± 12.8
Directive	4.3 ± 2.1	22.2 ± 37.3[b]	9.8 ± 1.1[a]	14.7 ± 14.8	34.9 ± 10.2
Dependent	11. 6 ± 31.0[c]	75.1 ± 84.9[c]	7.6 ± 6.4[a,c]	16.0 ± 12.6	49.1 ± 23.7[c]
F	3.199	14.145	4.892	1.842	4.817
P	0.043	0.000	0.003	0.14	0.003

Note: *Indicates the lack of data. "a" shows when compared with dependent pattern, P < 0.05. "b" stands for in comparison with pre-hospital pattern, P < 0.05. "c" means compared with directive pattern, P < 0.05.

accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Hainan General Hospital. Written informed consent was obtained from all participants.

Definitions and units used during the pre-hospital emergency patterns

Independent pattern: a medical unit that provides ambulance and hospital treatment services (e.g., Shenyang Emergency Center). Pre-hospital pattern: a medical unit that provides ambulance services only (e.g., Beijing Emergency Medical Center). Directive pattern: a medical unit that accepts emergency phone calls only. In this case, the ambulance and hospital treatment services are allocated to the ambulance network hospitals admitting patients (e.g., Shenzhen Emergency Center). Dependent pattern: an ambulance center that relies on a large general hospital, though the personnel and financial departments are relatively independent (e.g., Chongqing Emergency Medical Center).

Judgment, inclusion, and exclusion criteria

The diagnostic criteria of ACS were based on the "2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" [1]. The judgment criteria were: chest pain level decreasing; vital signs improves; manifestation of the electrocardiograph (ECG) improves (the elevated ST-segment becomes resolute ≥ 1 mm; the inverted T-wave returns to normal; the emerging conduction block or other cardiac arrhythmia returns to normal). Any ambulance intervention that was in line with the above criteria was seen as effective treatment. Patients whose main cause of complaint was chest pain, whom the medical personnel assumed to be an ACS patient, ad those who were suspected to have ACS by the emergency personnel on call were included in the study. ACS patients who were directly admitted to the hospital without any diagnoses and treatment as directed by the emergency personnel and those ACS patients who were transported from an inferior hospital to a superior one were excluded from the study

The questionnaire on the effect ambulance intervention has in ACS patients

A self-designed questionnaire on the ambulance intervention effect on ACS patients (**Table 1**) was used to collect index data on the emergency medical services from 13 units.

Following the initial medical investigations conducted in the emergency department of Central South University Xiangya College of Medicine Affiliated Haikou Hospital, the effective rate was of 52.4% (11 patients our of a total of 21). It should be noted that based on the calculus formula, the standard sample size should be of 100.

There were three people in charge of the questionnaire outcome: the specific investigator, responsible for collecting and recording the data; he/she was trained on July 8, 2009; the project leader, responsible for the construction of the questionnaires during the study period; the designated person, responsible for arranging the materials written by the specific investigator. If the questionnaire was missing data from three or more patients, the questionnaire was not validated.

Statistical analysis

EpiData 3.02 software was used to verify the data, and a double entry variant was used to guarantee the data quality. All the data were analyzed by using SPSS 13.0 statistical software (SPSS Inc., Chicago, IL, USA). Single factor analysis of variance or t-test was used to compare the measurement data among different groups. Chi-square test method was used to compare the enumeration data. The multivariate unconditional Logistic regression analysis (Stepwise method) was performed to analyze the effects of different indexes on the pre-hospital treatment efficacy. The pre-hospital treatment efficacy (effective, ineffective) was used as the dependent variable, and the variables with statistical difference in single factor analysis were used as the independent variables. $P < 0.05$ was considered as statistically significant.

Results

Total outcomes after emergency aid

The total effective rate of ACS pre-hospital intervention was 48.0%. Besides, the effective rates of the independent, pre-hospital, directive and dependent pattern were 70.0% (21/30), 38.5% (25/65), 47.5% (47/99) and 48.5% (32/66), respectively. There was significant difference between the pre-hospital pattern and independent pattern ($P < 0.05$).

Comparisons of time-consuming and ambulance trip distance

Table 2 showed that there were significant differences between index for the distances of ambulance driving of the directive and dependent patterns ($P < 0.05$). The index for the help response time evidenced the significant differences among the directive, pre-hospital, and dependent patterns ($P < 0.01$). Further, significant differences were found between the independent, directive, and dependent patterns in call-arrival time index ($P < 0.01$); and between the directive and dependent patterns in the total time interval index ($P < 0.01$). Besides, the therapeutic effect of ACS included the pre-hospital pattern (OR = 4.097), the directive pattern (OR = 5.158), nitrate drug (OR = 3.045), and oral dosing (OR = 8.215).

Comparison of the site disposal

Table 3 showed that there were significant differences in vital signs monitoring index ($P < 0.01$) when comparing the dependent pattern with the pre-hospital and directive pattern, respectively. Further, the differences in intravenous access index ($P < 0.01$) were significant when comparing the directive and dependent patterns with the independent and pre-hospital patterns, respectively. High differences were found in the nitrate index ($P < 0.01$) when independent pattern was compared with pre-hospital and dependent pattern, respectively. Furthermore, there were marked differences in sedation and analgesia index ($P < 0.05$) when comparing the directive pattern with the dependent pattern. The differences in pre-hospital ECG index ($P < 0.01$) were also significant when pre-hospital pattern was compared with the directive and dependent pattern, respectively, and when independent pattern was compared with the dependent pattern.

Multivariate logistic regression analysis of influencing factors for pre-hospital treatment efficacy

The multivariate logistic regression analysis (**Table 4**) showed that, when considering the ineffective intervention risk index, the pre-hospital pattern was 4.097 times the independent pattern, while the directive pattern was 5.158 times the independent pattern; the intervention with nitrate was 3.045 times the one without using nitrate. Furthermore, when analyzing the in-hospital drug delivery route, the drug delivery via an intravenous access was 8.215 times the oral dosing.

Discussion

ACS pre-hospital disposal analysis of the four patterns: When considering the distance for ambulance driving indexes of the four patterns, that of the directive pattern is significantly smaller compared with that of the dependent pattern. Additionally, no information was available on the pre-hospital pattern index due to the lack of data regarding the distance for ambulance driving. There is a need for further research to identify whether the directive pattern integrates its first aid resources in the emergency network hospitals to reduce the distance for ambulance driving. In order to improve

Table 3. Comparison of site disposal in four ambulance patterns (n, %)

Pattern	Total	Vital signs monitoring		Intravenous access		Oxygen		Aspirin		Nitrates		Sedation and analgesia		Pre-hospital ECG	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Independent	30	30, 100%	0,0	30, 100%	0, 0	27, 90%	3, 10%	26, 88.3%	4, 11.7%	24, 80%	6, 20%	21, 6.9%	9, 93.1%	27, 89.7%	3, 10.3%
Pre-hospital	65	65, 100%	0,0	65, 100	0, 0	61, 93.8%	4, 6.2%	51, 78.7%	14, 21.3%[a]	35, 52.3%	30, 47.7%[a]	20, 3.1%	45, 96.9%	58, 89.2%	7, 10.8%
Directive	99	98, 98.9%	1, 1.1%	38, 37.9%	61, 62.1[a,b]	92, 92.6%	7, 7.4%	60, 60.4%	39, 39.6%[b]	67, 67.4%	32, 32.6%	0,0	99.100%	64, 64.2%	35, 35.8%[b]
Dependent	66	58, 87.9%	8, 12.1%[b,c]	71.2%	8.8[a,b,c]	58, 87.9%	8, 12.1%	48, 72.6%	18, 27.4%[b]	35, 53%	31, 47.0%[a]	6, 9.1%	60, 90.9%[c]	37, 56.1%	29, 43.9%[a,b]
X^2		19.57		86.59 9		1.795		20.851		10.018		9.363		24.848	
P		0.000		0.000		0.616		0.000		0.018		0.025		0.000	

Note: “a” represents when compared with independent pattern, P < 0.05; “b” indicates that when compared with pre-hospital pattern, P < 0.05; “c” says that when compared with directive pattern, P < 0.05.

Table 4. Multivariate logistic regression analysis of the intervention effect (Stepwise method)

Index	B	SE	Wald	P	OR	95.0% CI	
						Lower	Upper
Independent pattern			8.159	0.043			
Pre-hospital pattern	1.410	0.635	4.930	0.026	4.097	1.180	14.227
Directive pattern	1.641	0.635	6.682	0.010	5.158	1.487	17.893
Dependent pattern	0.852	0.658	1.679	0.195	2.345	0.646	8.511
Nitrate	1.114	0.392	8.058	0.005	3.045	1.412	6.570
Drug delivery via intravenous access	2.106	0.466	20.423	0.000	8.215	3.296	20.476
Constant	-6.436	1.102	34.131	0.000	0.002		

Note: B: Regression coefficient; SE: Standard error; Wald: Corresponding to χ^2 value; P: Probability; OR: Odds ratio; CI: Confidence interval.

the existing emergency network, the present data suggest the organization and management experiences of the directive pattern can be used to improve the other three pattern indexes.

The ambulance consuming time indexes of the four patterns: The call-response time index shows significant differences between the directive pattern and the pre-hospital and dependent patterns. When analyzing the call-arrival time index, there is a significant difference between the independent and directive patterns and the dependent pattern. The directive pattern is shorter in the distance for ambulance driving, but longer in call-arrival time duration. Our emergency staff should consider reducing the treatment length. This reduction depends on a series of factors, such as the patients' understanding of ACS, the improvement of the professional standard by the hospitals' emergency departments, the continuous improvement of China's emergency system and coordination of the community related sectors [13].

In seven ACS ambulance intervention indexes of the four patterns, the pre-hospital and independent patterns are better when compared with the directive and dependent patterns. In this direction, when considering the sedation and analgesia index, the dependent pattern is slightly higher than the other patterns, though only 9.1% of the ACS patients are administered sedative and analgesic drugs. In terms of the aspirin index, the pre-hospital pattern surpasses the other three patterns, though only 24.6% of patients are given aspirin drugs. When analyzing the intravenous access index, the directive pattern was shown to be the lowest and to pose significant medical risks for the patients with chest pain, as in 62.1% of them intravenous access was not established. When analyzing the final curative effect index, the independent pattern surpasses the other three patterns (effective rate: 70.0%), though its various disposal indexes are similar to those of the pre-hospital pattern.

Furthermore, when analyzing the four patterns in terms of the pre-hospital site preliminary disposal, the independent pattern has the best treatment effect; still further research is needed to confirm if this result is related to the pattern's continuous treatment method. Further, the site preliminary disposal of the pre-hospital pattern showed high results. Furthermore, additional research is necessary to conclude if this is related to the professionalism demonstrated during the emergency service. From a local point of view, When analyzing the use of sedative and analgesic drugs, results show that the dependent pattern is more active than the other three one (9.1%). Additionally, when measuring the various disposal indexes, the directive pattern is relatively low when compared with the other three patterns. This result can be associated with the stratification risk of the ACS patients of the directive pattern, as the low and moderate risks (totally 78.8%) account for the major part.

The analysis of the four patterns and the overall treatment effect: There are various reasons that lead to different treatment effects in multiple ambulance patterns [14, 15]: 1) Independent emergency center: the decrease in the medical and health resources, their reduced use, and increase in self-cost, caused by the resource investment doubling or over-

lapped functions; 2) Directive emergency center: the health administrative department faces various administrative constraints in various types of hospitals. While for cases of major disasters emergency, it is possible for the medical personnel to work together, for cases of daily first aid, the fast response time cannot be effectively reduced due to the increase in distress-rescue intermediate links. For this unconstrained emergency, high efficiency in the organization system is difficult to achieve. When drizzle problems or special cases arise, such as the inability to pay medical fees, or medical disputes, the directive center is difficult to coordinate; 3) Pre-hospital emergency center: the ambulance intervention is easily separated from the in-hospital treatment. The coordination of patients for the in-hospital treatment becomes the major medical concern of the emergency center. The most difficult work-related situations arise when, due to the difference in medical knowledge and disease principles, medical discrepancies occur or intensify [16]; 4) Dependent emergency center: it the hospital department functions in parallel with other hospital emergency departments. In this way, it proves to be inefficient in its coordination activities, by limiting its social function and affecting the pre-hospital emergency care objective and quality.

After analyzing 260 cases collected in this investigation, we found that the total effective rate of the ACS ambulance intervention is only 48.0%; this should be improved. More specifically, the total effective rate of the independent pattern is as high as 70.0%, which is significantly higher than that of the pre-hospital pattern (38.5%). Due to the non-uniformity of the ACS ambulance intervention criteria, this study cannot be compared with other similar studies. Hence, we believe there is an urgent need to harmonize the domestic ACS ambulance intervention standards, especially to develop our domestic ACS ambulance intervention guides as soon as possible.

Analysis of the dominant factor of the treatment effect: the independent emergency, the pre-hospital emergency and the directive emergency patterns, the use of nitrates, and in-hospital drug delivery route were selected for this analysis. Additionally, the independent emergency pattern, the use of nitrates, and the oral dosing after the emergency personnel arrival were factors that strongly influenced the treatment effect [17]. We further showed that the independent emergency pattern has the best ACS ambulance intervention effect and the lowest risk, compared with the other three emergency patterns. Besides, the use of nitrates and oral dosing has the highest impact on the pre-hospital intervention process [18, 19].

Conclusions

The present study included 260 ACS patients in ambulance care in 7 emergency aid centers. We analyzed the ACS treatment situations in the major emergency aid centers and emergency network hospitals from the biggest media-sized cities in China. The end results of the ambulance-related care measurements are as follows: 1) the four ambulance care patterns of the distance during ambulance driving, the call-response and call-arrival time intervals are necessary to compensate for the shortfall created by any of the patterns; 2) in ACS ambulance treatments, the proper drug use (aspirin, applied sedatives, and nitrates) is required to increase from the low-down level; 3) apart from the independent pattern, the other three showed no significant difference in the ACS pre-hospital intervention; 4) the total effective rate of 48% in the ACS ambulance intervention should be improved.

Acknowledgements

This study was supported by the project founded by National Natural Science Foundation of China in 2010 (No.81060160).

Disclosure of conflict of interest

None.

Address correspondence to: Min Li, Department of Emergency, Hainan General Hospital, Haikou 570311, China. Tel: +86 898 66222502; Fax: +86 898 66222502; E-mail: MinLIdoc@163.com

References

[1] Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, Samson RA, Kattwinkel J, Berg RA, Bhanji F, Cave DM, Jauch EC, Kudenchuk PJ, Neumar RW, Peberdy MA, Perlman JM, Sinz E, Travers AH, Berg MD, Billi JE, Eigel B, Hickey RW, Kleinman ME, Link MS, Morrison LJ, O'Connor RE, Shuster M, Callaway CW, Cucchiara B, Ferguson JD, Rea TD and Vanden Hoek TL. Part 1: executive

summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2010; 122: S640-656.
[2] Francis RC, Bubser F, Schmidbauer W, Spies CD, Sörensen M, Bosse G and Kerner T. Effects of a standard operating procedure on prehospital emergency care of patients presenting with symptoms of the acute coronary syndrome. Eur J Emerg Med 2014; 21: 236-239.
[3] Harding A and Mangini S. A review of the American Heart Association implementation and integration of prehospital ECGs into systems ofcare for acute coronary syndrome. J Emerg Nurs 2010; 36: 35.
[4] Quinn T, Johnsen S, Gale CP, Snooks H, McLean S, Woollard M and Weston C. Effects of prehospital 12-lead ECG on processes of care and mortality in acute coronary syndrome: a linked cohort study from the Myocardial Ischaemia National Audit Project. Heart 2014; 100: 944-950.
[5] Assez N, Smith G, Adriansen C, Aboukais W, Wiel E and Goldstein P. Acute coronary syndromes: is there a place for a real pre-hospital treatment for patients "en route" to the coronary intensive care unit? EuroIntervention 2012; 8: P36-43.
[6] Bruins Slot MH, Rutten FH, van der Heijden GJ, Doevendans PA, Mast EG, Bredero AC, Glatz JF and Hoes AW. Gender differences in pre-hospital time delay and symptom presentation in patients suspected of acute coronary syndrome in primary care. Fam Pract 2012; 29: 332-337.
[7] Perkins-Porras L, Whitehead DL, Strike PC and Steptoe A. Causal beliefs, cardiac denial and pre-hospital delays following the onset of acute coronary syndromes. J Behav Med 2008; 31: 498-505.
[8] Gemes G, Fuchs TJ, Wildner G, Smolle-Jüttner FM, Smolle J, Stoschitzky K and Prause G. The acute coronary syndrome--pre-hospital diagnostic quality. Resuscitation 2005; 66: 323-330.
[9] Lefort H, Fradin J, Blgnand M and Tourtier JP. Pre-hospital management of acute coronary syndrome. Soins 2015; 39-43.
[10] Mackay MH, Ratner PA, Nguyen M, Percy M, Galdas P and Grunau G. Inconsistent measurement of acute coronary syndrome patients' pre-hospital delay in research: a review of the literature. Eur J Cardiovasc Nurs 2014; 13: 483-493.
[11] Garofalo D, Grey C, Lee M, Exeter D and Kerr AJ. Pre-hospital delay in acute coronary syndromes: PREDICT CVD-18. N Z Med J 2012; 125: 12-22.
[12] Mooney M, McKee G, Fealy G, O'Brien F, O'Donnell S and Moser D. A review of interventions aimed at reducing pre-hospital delay time in acute coronary syndrome: what has worked and why? Eur J Cardiovasc Nurs 2012; 11: 445-453.
[13] Glover BM and Adgey AA. Acute reperfusion strategies for ST-segment elevation myocardial infarction. Eur Heart J 2008; 29: 571-572.
[14] Jacobs I, Nadkarni V, Bahr J, Berg RA, Billi JE, Bossaert L, Cassan P, Coovadia A, D'Este K, Finn J, Halperin H, Handley A, Herlitz J, Hickey R, Idris A, Kloeck W, Larkin GL, Mancini ME, Mason P, Mears G, Monsieurs K, Montgomery W, Morley P, Nichol G, Nolan J, Okada K, Perlman J, Shuster M, Steen PA, Sterz F, Tibballs J, Timerman S, Truitt T and Zideman D. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries: a statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Councils of Southern Africa). Circulation 2004; 110: 3385-3397.
[15] Morrison LJ, Verbeek PR, McDonald AC, Sawadsky BV and Cook DJ. Mortality and prehospital thrombolysis for acute MI: A meta-analysis. JAMA 2000; 283: 2686-2692.
[16] Prause G, Wildner G, Kainz J, Bössner T, Gemes G, Dacar D and Magerl S. Strategies for quality assessment of emergency helicopter rescue systems. The Graz model. Anaesthesist 2007; 56: 461-465.
[17] Collet JP, Dumaine R, Ecollan P, Beygui F, Choussat R, Boon G, Payot L and Montalescot G. Antithrombotics in pre-hospital phase of acute coronary syndromes. Arch Mal Coeur Vaiss 2005; 98: 1118-1122.
[18] Andersen HR, Nielsen TT, Rasmussen K, Thuesen L, Kelbaek H, Thayssen P, Abildgaard U, Pedersen F, Madsen JK, Grande P, Villadsen AB, Krusell LR, Haghfelt T, Lomholt P, Husted SE, Vigholt E, Kjaergard HK and Mortensen LS. A comparison of coronary angioplasty with fibrinolytic therapy in acute myocardial infarction. N Engl J Med 2003; 349: 733-742.
[19] Svensson L, Karlsson T, Nordlander R, Wahlin M, Zedigh C and Herlitz J. Safety and delay time in prehospital thrombolysis of acute myocardial infarction in urban and rural areas in Sweden. Am J Emerg Med 2003; 21: 263-270.