An Utstein-Style Investigation into Prognoses Observed from the Condition of the Out-of-Hospital Cardiac Arrest Patients

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ABSTRACT

Objective: The goal of this study is to evaluate the association between the conditions of the victims at the time of the 119 calls and the patient's prognoses.

Methods: 1,511 cases from the emergency medical service records were retrospectively investigated using the Utstein Style from July 1, 2010 to September 30, 2012. The presence of consciousness, a pulse, and respiration were evaluated to confirm the condition of the victims. The consciousness cases at the time of 119 calls were further classified into groups based upon their chief complaints. To evaluate the association between the condition of the victims and his or her prognosis, each condition was compared with unconscious cases without respiration.

Results: The 1-month survival rate was significantly higher in conscious cases with chest / back pain or dyspnea, conscious and faint cases, unconscious cases with respiration, unconscious cases with breathing unknown, and unconscious cases with seizure at the time of the 119 emergency call (p<0.001, p=0.004, p<0.001, p=0.042, and p=0.001, respectively). In multivariate analysis, conscious cases with chest / back pain or dyspnea (OR=9.298, 95%CI=4.373-19.768), unconscious cases with respiration (OR=3.884, 95%CI=2.166-6.964), and unconscious cases with breathing unknown (OR=1.915, 95%CI=1.129-3.247) were significant prognostic factors.

Conclusion: The subsequent survival rate is particularly high in cases with chest / back pain or dyspnea, and cases in which the bystander could not confirm respiratory arrest. It is pivotal to provide appropriate instructions on resuscitation, without overlooking important signs that have an impact on survival in these cases.

Keywords: Emergency medical dispatch, out-of-Hospital Cardiac Arrest, Instructions for CPR

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INTRODUCTION

In the American Heart Association Guideline 2010 (AHA-G2010), the importance of emergency medical dispatch for out-of-hospital cardiac arrest (OHCA) cases has been reported (1). Instructions for cardiopulmonary resuscitation (CPR) by dispatchers are expected to improve the bystander CPR rate as well as prognoses and it is considered adequate to provide all suspected cardiopulmonary arrest (CPA) cases with instructions for CPR (1, 2). However, it is often difficult to determine whether they are cases of CPA or at a previous phase when obtaining information over the phone. This makes it crucial to be able to recognize critical signs so that better prognoses can be made based on the content of the 119 call. If the condition of the victim can be associated with his or her prognosis at the time of the 119 call, it may be possible for dispatchers to focus more on collecting information and providing suitable CPR instructions for cases in which the patient is already in, or may go into CPA.

The goal of this study is to determine the association between the conditions of the victims and the prognoses at the time of the 119 call in order to improve outcome.

MATERIALS AND METHODS

The author's institution has been involved in the validation of Emergency Medical Services (EMS) records as part of prefectural medical control since July 1, 2010 and has confirmed all EMS records requiring hospitalization. In the present study, 1,511 EMS records in the Utstein style submitted by prefectural fire departments were evaluated in an attempt to validate all of

the cases requiring hospitalization during the period between July1, 2010 and September 30, 2012.

The conditions of the victims at the time of 119 calls were evaluated based on their consciousness, pulse, and respiration, as reported by the callers. The consciousness cases were further classified into groups based upon their chief complaints. Vomiting is commonly seen in patients experiencing OHCA and it has been reported that it occurs in 1/3 of patients experiencing cardiac arrest (3). However, because there were cases in which the time of occurrence of vomiting was unclear, such as cases with insufficient descriptions and cases with CPR-induced vomiting, these cases were excluded, with the exception of cases in which vomiting was their only primary symptom. Also, since dispatchers should consider that brief generalized seizure may be the earliest symptom of cardiac arrest (4, 5), it was a separate evaluation point. Because rescue efforts are first required prior to resuscitation for accidents in the bath tub, hanging, near-drowning, and trauma, it was believed that it would be difficult to study any association with prognosis. Therefore, these cases were considered as a separate category.

In addition, cases being transferred from a hospital to another hospital were also considered as a separate category. To reflect the exact contents of the caller, even if the respiratory arrest was expected from the condition of the victims and EMS records, these cases were classified into the breathing cases. The condition of the victims at the time of 119 calls were also classified into conscious with chest pain / back pain / respiratory discomfort, conscious with vomiting / hematemesis, conscious with faint, conscious with stupor, conscious with coughing / hemosputum, conscious with discomfort, conscious with abdominal pain, conscious with bleeding from a wounded area, unconscious without respiration, unconscious with respiration, unconscious with unknown respiration, unconscious

with pulse, unconscious with seizure, unconscious in a bath tub, unconscious due to hanging, unconscious due to near-drowning, unconscious due to trauma, and request to send the patient to another hospital.

To evaluate the association between the condition of the victims and his or her prognosis, each condition was compared with unconscious cases without respiration since these were definitive CPA cases. The 1-month survival rate was used to assess the prognosis. Statistical analysis was performed using the student two-tailed test, the chi-square test and a Fisher's exact test using SPSS Statistics ver. 19 (IBM®). A value of $p<0.05$ was determined to be statistically significant.

In addition, the multivariate analysis was performed to identify prognostic factors in relation to patient status at the time of the 119 call.

This study was approved by the Institutional Review Board.

RESULTS

The percentages based on the condition of the victims at the time of 119 calls were as follows: conscious cases with chest pain / back pain / respiratory discomfort accounted for 3.2% (48/1511), conscious cases and others for 1.9% [vomiting / hematemesis 0.3% (5/1511), faint 0.2% (3/1511), stupor 1.1% (16/1511), coughing / hemosputum 0.1% (2/1511), feeling discomfort 0.1% (1/1511), abdominal pain 0.1% (1/1511), bleeding from the wounded area 0.1% (1/1511)], unconscious cases without respiration for 25.8% (390/1511), unconscious cases with respiration for 11.9% (180/1511), unconscious cases with unclear respiration for 31.2% (472/1511), unconscious cases with a pulse for 1.0% (15/1511), unconscious cases with seizure for 0.9% (13/1511), unconscious cases with face submerged in the bath tub for

4

9.5% (144/1511), unconscious cases involving hanging for 5.7% (86/1511), unconscious cases drowned in water passage / river / sea, etc. for 2.2% (33/1511), cases involving external injuries such as traffic accidents for 6.0% (90/1511), and cases with the request to be transferred to another hospital for 0.7% (11/1511) (Table 1). Moreover, cases with consciousness accounted for 5.1% of the total (77/1511). Of those, the cases involving chest pain / back pain / respiratory discomfort accounted for the largest group at 62.3% (48/77), in addition to vomiting/hematemesis for 6.5% (5/77), faint for 3.9% (3/77), stupor for 20.8% (16/77), coughing / hemosputum for 2.6% (2/77), and feeling discomfort / abdominal pain / bleeding in the wounded area for 1.3% (1/77).

Next, an association between the condition of victims at the time of the 119 calls and prognosis was evaluated. When compared with unconscious cases with no respiration [3.3%(13/389)], which were the definitive CPA cases, conscious cases with chest pain / back pain / respiratory discomfort [25.0% (12/48): p<0.001], conscious cases with faint [66.7% (2/3) p=0.004], conscious cases with bleeding from a wounded area [100%(1/1): p=0.036], unconscious cases with respiration [12.2% (22/180): p<0.001], unconscious cases with unclear respiration [6.4% (30/467): p=0.042], and unconscious cases with seizure [30.8% (4/13): p=0.001] showed significantly higher 1-month survival rates while unconscious cases with face submerged in the bath tub [0% (0/144): p=0.024] showed a significantly lower 1-month survival rate (Table 1).

In multivariate analysis, consciousness with chest / back pain or dyspnea (odds ratio: 9.298, 95% CI: 4.373-19.768), unconsciousness with respiration (odds ratio: 3.884, 95% CI: 2.166-6.964), and unconsciousness with breathing unknown (odds ratio: 1.915, 95% CI: 1.129-3.247) were significant prognostic factors to predict 1-month survival (Table 2).

DISCUSSION

A creation of guidelines (1, 6), the importance of the "Chain of Survival" (7), a recommendation of automated external defibrillator (AED) (8), and efficacy of hypothermia therapy have been previously reported to improve the prognoses of cases of OHCA (9, 10). Early CPR by bystanders is known to be profoundly important for increased survival rates of victims. However, it is also true that there were many cases that did not undergo bystander CPR (11).

One of the reasons for this is that the caller often falsely interprets agonal respiration and abnormal respiration as normal respiration when he or she checks for the presence of respiration (1). Therefore, in AHA-G2010, early recognition of cardiac arrest is a primary focus and requires that a dispatcher ask about the presence of consciousness and the quality of respiration (whether it is normal respiration), so that a bystander can recognize cardiac arrest (1). Because the instructions for CPR over the phone for victims who are not conscious and whose respirations are not normal increase the rate of bystander CPR and substantially improve survival rates for cardiac arrest, it is described that all dispatchers should be trained to be able to provide bystander with proper CPR instruction (1, 2).

It is actually important to avoid both the caller and the dispatcher missing cardiac arrest in the following situations: when the caller mistakenly judges that there is consciousness, respiration, and a pulse; and when cardiac arrest is reached after the 119 call. However, there are only a few specific reports regarding what symptom should require specific attention during 119 calls. If dispatchers could recognize critical signs that may result in cardiac arrest, his or her prognosis may be better if treated properly at the time of the 119

call; more careful and high quality telephone CPR instructions could be provided to bystanders from EMS personnel.

Müller, et al. reported that in cases of cardiogenic cardiac arrest that were witnessed, patients with respiratory distress and dizziness / faint were prone to go into cardiac arrest ten minutes after the onset of initial symptoms (12). They further reported that initial symptoms of the patients with subsequent cardiac arrest within one hour of onset include anginal pain which accounted for 33%, respiratory discomfort for 30%, dizziness / faint for 15%, nausea / vomiting for 10%, and others for 12%. Moreover, it has been reported that prodromal symptoms of cases with witnessed CPA included anginal pain which accounted for 43%, severe respiratory discomfort for 7%, dizziness / palpitation for 4%, nausea / feeling discomfort for 21%, and no complaints for 25% (13). In the present study, conscious cases at the time of 119 calls accounted for 5.1%. That is to say that at least approximately 5% of the victims reached a state of cardiac arrest after the 119 calls and by the time the EMT arrived at the scene.

Consistent with previous reports, the data obtained in the present study showed that cases involving chest pain / back pain / respiratory distress accounted for 62.3%, followed by stupor for 20.8%, vomiting / hematemesis for 6.5%, and faint for 3.9%. Thus it is necessary to pay attention to the transition to cardiac arrest in such cases. However, there was no statistical significance in terms of one month survival rate between patients with CPA and stupor. It is considered that caller may recognize the patient with a CPA as with a stupor. Therefore, it is necessary to consider the patient with a stupor as a possible CPA case.

Additionally, it is expected that cases with reportedly normal respiration or unclear respiration at the time of the 119 calls might have included cases with agonal respiration or impending cardiac arrest. Such cases are certainly good candidates in which patient survival

can be expected with appropriate bystander CPR. Since the present study showed that the prognosis of unconscious cases with unclear respiration can be significantly better than in unconscious cases with no respiration, the AHA-G2010 instructions would definitely be adequate for cases in which determining the respiratory status is difficult due to the inarticulacy and confusion of callers.

According to the study results on the prognostic factors, a high subsequent survival rate was observed particularly in conscious cases with chest pain / back pain / respiratory distress, despite which is high risk to lead to cardiac arrest after calls. This suggests that it would be necessary to provide proper instructions and resuscitation for these patients. Specifically, it is recommended that dispatchers should be educated in advance to be able to recognize these critical signs that may cause cardiac arrest. Furthermore, callers should be educated to make an immediate additional 119 call when they found conscious patients lost their consciousness. Additionally, it is important and necessary for EMS personnel to call informer from the ambulance on its way to the scene to reconfirm the condition of the victims (14).

There are some limitations in this study. First of all, as might be expected, many of the callers who discover the patient with cardiac arrest tend to be overwhelmed, therefore it should be very difficult for them to evaluate patient's breathing and consciousness. Secondly, since the prognosis of this study is based on one month survival rate, an evaluation of the long-term prognosis including favorable neurological status by expanding sample sizes will be needed in the future. Finally, it might be possible that the data can vary depending on each region, as the data was obtained from only one prefecture in this study. Thus further investigation including more data from all over Japan is warranted.

Moreover, it is imperative to evaluate what kind of symptom dispatchers should pay

more specific attention when they receive 119 call.

CONCLUSION

The subsequent survival rate is high particularly in conscious cases with chest pain / back pain / respiratory distress at the time of the call, in cases in which the caller cannot affirm respiratory arrest, it is necessary to provide proper instructions and resuscitation for successful outcomes.

AUTHORS' NOTE

T Iwamura conceived paper, conducted data analysis, wrote manuscript and approved final version. S Inoue participated in study design, interpretation of data, critically revised manuscript and approved final version. KC Yamada participated in study design, data analysis and interpretation, revision of manuscript and approved final version. H Koami, T Miike, M Yahata, and H Imahase participated in study design, interpretation of data, revision of manuscript and approved final version. Y Sakamoto provided oversight to study, participated in data interpretation and revision of manuscript, and approved final version. The authors declare that they have no conflicts of interest.

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Table 1: The relation between the status of the sick and wounded at the time of the 119 emergency call and the prognosis.

Conditions at the time of 119 calls	Case		1 month survival		p
	N	%	N	%	
Conscious case					
Chest pain / Back pain / Respiratory discomfort	48	3.2	12	25.0	< 0.001
Vomiting / Hematemesis	5	0.3	1	20.0	0.166
Faint	3	0.2	2	66.7	0.004
Stupor	16	1.1	1	6.7	0.416
Coughing / Hemosputum	2	0.1	0	0	1.000
Feeling discomfort	1	0.1	0	0	1.000
Abdominal pain	1	0.1	0	0	1.000
Bleeding from the wounded area	1	0.1	1	100	0.036
Unconscious case					
Without respiration	390	25.8	13	3.3	—
With respiration	180	11.9	22	12.2	< 0.001
Unclear respiration	472	31.2	30	6.4	0.042
With a pulse	15	1.0	1	6.7	0.416
With seizure	13	0.9	4	30.8	0.001
Bath tub	144	9.5	0	0	0.024
Hanging	86	5.7	2	2.3	1.000
Drowning	33	2.2	3	9.1	0.121
Trauma	90	6.0	0	0	0.141
Hospital transfer	11	0.7	0	0	1.000

＊A conscious case with stupor and an unconscious case with no respiration were left in blank.

＊5 unconscious cases with unclear respiration were left in blank.

12

Table 2: Multivariate analysis of the status of the sick and wounded at the time of the 119 emergency call and the prognosis.

Conditions at the time of 119 calls	Partial regression coefficient	Significance probability (p)	Odds ratio (95% CI)
Consciousness with chest pain / back pain / respiratory discomfort	2.230	< 0.001	9.298 (4.373–19.768)
Unconsciousness with respiration	1.357	< 0.001	3.884 (2.166–6.964)
Unconsciousness with breathing unknown	0.650	0.016	1.915 (1.129–3.247)