A Relationship between the Injury Characteristics of Trauma Patients and Hospitalization in a Region

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Abstract

The purpose of this study was to investigate the association between the injury characteristic factors and hospitalization of trauma patients in a single region. This study was conducted in 193 subjects transferred to the emergency medical center at a hospital in U Metropolitan City from January 1 to December 31, 2013. The analysis was performed using an SPSS WIN 20.0 program. As for the emergency treatment items at the pre-hospital stage, emergency patients treated with a cervical plate were 15.49 times more likely to be hospitalized than those treated with Stability assistance (p=0.001). As for hospitalization based on the final diagnosis for all of the trauma patients at the in-hospital stage, they were 4.91 times more likely to be hospitalized due to fracture than due to scratches/others (p=0.028). As shown in the results of this study, there are a diversity of complicated injury types and accident characteristics. It is therefore necessary to make institutional reinforcement and supplement injury prevention programs.

Keywords: Injury, Hospitalization, Trauma

1. Introduction

Recent data of 2014 of KoStat¹ have indicated that for the morality due to trauma or exogenous factor (accidental death) classified under the general term which includes death caused by exogenous factor (28.1 persons) as the highest per 0.1 million of the population, followed by traffic accidents (12.9 persons) and falling accidents (4.2 persons). For the trauma mortality, traffic accidents were ranked highest at the age group of 1~9 and suicide was most frequently indicated at the total age group, above ten years old, followed by traffic accidents.

Moreover, KNPA Police² revealed a recent data of 2014 that 216,235 cases of traffic accidents happened for the year of 2013, of which 329,415 persons were injured by trauma. According to Son et al.³, TAAS (Traffic Accident Analysis System) of KoROAD and Injury Surveillance Data of CDC based on the patients of emergency rooms of CDC were built for encouraging the strategy for injury prevention. Although there has been some management of integrated national surveillance system through the interdisciplinary connection, it is true that there are much to do for analyzing and using those injury data nationally.

However, Nam⁴ has suggested that it is difficult to prepare the base data for establishing strategies for injury prevention because the trauma was not yet included in the priorities of health science in Korea. From the perspective that trauma can be appeared by various causes and in different conditions, it is important to understand the various causes and severity of injury patients. Also, it is required the management and prevention plan of injury and it is necessary to examine the injury systematically and figure out the concrete risk factors because the
### Table 1. General characteristics of subjects

| Variable                      | N   | %    | Mean | S.D  |
|-------------------------------|-----|------|------|------|
| **Personal Characteristics**  |     |      |      |      |
| Gender                        |     |      |      |      |
| Male                          | 127 | 65.8 |      |      |
| Female                        | 66  | 34.2 |      |      |
| Age                           |     |      |      |      |
| 20 >                          | 13  | 6.7  | 48.68| 18.04|
| 20-40                         | 44  | 22.8 |      |      |
| 40-65                         | 103 | 53.4 |      |      |
| 65 ≤                          | 33  | 17.1 |      |      |
| **Pre-Hospital Characteristics** |   |      |      |      |
| Accident Time                 |     |      |      |      |
| 06-12                         | 41  | 21.2 |      |      |
| 12-18                         | 58  | 30.1 |      |      |
| 18-23                         | 47  | 24.4 |      |      |
| 23-06                         | 47  | 24.4 |      |      |
| Accident season               |     |      |      |      |
| Spring                        | 34  | 17.6 |      |      |
| Summer                        | 67  | 34.7 |      |      |
| Autumn                        | 42  | 21.8 |      |      |
| Winter                        | 50  | 25.9 |      |      |
| Accident place                |     |      |      |      |
| Home                          | 42  | 21.8 |      |      |
| Residential area              | 37  | 19.2 |      |      |
| Street                        | 72  | 37.3 |      |      |
| Public place/others           | 42  | 21.8 |      |      |
| Accident type                 |     |      |      |      |
| Laceration                    | 31  | 16.1 |      |      |
| Fall,                         | 60  | 31.1 |      |      |
| Traffic accident              | 59  | 30.6 |      |      |
| Blunt trauma/Others           | 43  | 22.3 |      |      |
| Injury position               |     |      |      |      |
| Face                          | 36  | 18.7 |      |      |
| Head/Neck                     | 62  | 32.1 |      |      |
| Limb/Pelvis                   | 70  | 36.3 |      |      |
| Chest/Abdomen/Bidy surface    | 25  | 13.0 |      |      |
| Emergency treatment           |     |      |      |      |
| Stability assistance,         | 47  | 24.4 |      |      |
| Cervical fixation,            | 34  | 17.6 |      |      |
| Manipulation                  | 46  | 23.8 |      |      |
| Hemostasis/Others             | 66  | 34.2 |      |      |
| Site arrival (minutes)        |     |      |      |      |
| 5>                            | 121 | 62.7 | 5.20 | 1.90 |
| 6≤                            | 72  | 37.3 |      |      |
| Hospital arrival (minutes)    |     |      |      |      |
| 10>                           | 66  | 34.2 | 11.96| 5.72 |
| 10-15                         | 81  | 42.0 |      |      |
| 15≤                           | 46  | 23.8 |      |      |
| **In-Hospital Characteristics** |   |      |      |      |
| Final diagnosis               |     |      |      |      |
| fracture                      | 26  | 13.5 |      |      |
| Laceration                    | 49  | 25.4 |      |      |
| Sprain/Bruise                 | 60  | 31.1 |      |      |
| Abrasion/others               | 58  | 30.1 |      |      |
| Surgery status                |     |      |      |      |
| Yes                           | 54  | 28.0 |      |      |
| No                            | 139 | 72.0 |      |      |
| Result of treatment           |     |      |      |      |
| Hospitalization               | 53  | 27.5 |      |      |
| Transfer                      | 12  | 6.2  |      |      |
| Return home                    | 128 | 66.3 |      |      |
prognosis can be depended on the proper emergency treatment and evacuation after injury.

Thus, this study selected trauma patients as subject, who were evacuated to emergency rooms by 119 rescue service in a region, to find their injury characteristics factors and examine and analyze a factor-related hospitalization. It is also useful for preparing a foundation for building up prehospital emergency medical service system and hospital emergency medical service system. Especially, it is more helpful for preparing the base data to establish the trauma system that was developed and advanced in the developed countries.

2. Research Methods

2.1 Subject and Method
For the period of a year ranging from January 1 to December 31, 2013, the 119 emergency treatment journals and medical records of 201 trauma patients were examined. 201 trauma patients were selected among 470 patients who were evacuated to hospital emergency rooms by an 119 service center under the fire department in U metropolitan city, except those classified as those with disease or other. Of 201 patients, eight patients were excluded because of insufficient data.

119 emergency treatment journals were collected directly by the researcher with the list of evacuated trauma patients after explaining the study and asking for help the representative of S 119 service center and those in charge of emergency treatment. Also, emergency treatment journal-related medical records were collected in cooperation with the person in charge of department of medical record, in the condition that research ethics should be obeyed, after fully explaining the purpose and content of the study to the representative of the emergency center.

This is retrospective research that involved the analysis of 119 rescue teams’ journals and medical records in a hospital for trauma patients. It was conducted on the basis of the collected emergency treatment journals and medical records in the hospital, attaching importance to the protection of personal information. The patients’ data were all reviewed; then, those of 193 trauma patients who met the 13 variables were divided into personal, pre-hospital stage and in-hospital stage characteristics. The association between the relevant factors of the trauma patients and hospitalization was assessed. The general characteristics of the subjects are presented in Table 1.

2.2 Definition of Terms

2.2.1 Theoretical Definition of Trauma Patient
The National Institute of the Korean Language (NIKL) defines it as a wound on the surface of the body or as a person who needs treatment due to an illness or injury.

2.2.2 Operational Definition
A trauma patient in this study refers to the one who was injured from an accident and was transported to the emergency medical center of a hospital in U Metropolitan City by a 119 rescue team. The category of injuries covers laceration, fall, traffic accidents, blunt trauma and others.

2.3 Analysis
Collected data for the study were statistically analyzed with IBM SPSS WIN 20.0 program through data coding and data cleaning. The significance level was set at p<0.05.

3. Results

3.1 Association between Personal Characteristics and Hospitalization
The association between the personal characteristics and hospitalization is presented in Table 2. Both the
males (50.3%) and females (22.3%) were less likely to be hospitalized, which was not statistically significant. The age group was also statistically insignificant.

3.2 Association between Pre-Hospital Stage Characteristics and Hospitalization

The association between the pre-hospital stage characteristics and hospitalization is presented in Table 3. There was no statistically significant difference in accident time for the patients. As for the season in which accidents occurred, they were more likely to be hospitalized in the autumn (9.8%) and were less likely to be non-hospitalized in the summer (28.0%), which was statistically significant (p<0.05).

As for the accident place, both hospitalization (16.1%) and non-hospitalization (21.2%) were more likely to be related to streets, which was statistically significant (p<0.01). As for accident types, hospitalization was highly related to traffic accidents (15.5%) and non-hospitalization was highly related to fall (23.8%), which was statistically significant (p<0.01).

Table 3. Association between pre-hospital stage characteristics and hospitalization

| Hospitalization status | N | Hospitalization | Non-hospitalized | $x^2$ | p   |
|------------------------|---|-----------------|------------------|------|-----|
| Accident Time          |   |                 |                  |      |     |
| 06-12                  | 41| 16(8.3%)        | 25(12.9%)        | 5.511| 0.138|
| 12-18                  | 58| 17(8.8%)        | 41(21.3%)        |      |     |
| 18-23                  | 47| 12(6.2%)        | 35(18.2%)        |      |     |
| 23-06                  | 47| 08(4.1%)        | 39(20.3%)        |      |     |
| Accident season        |   |                 |                  |      |     |
| Spring                 | 34| 09(4.7%)        | 25(12.9%)        | 9.165| 0.027|
| Summer                 | 67| 13(6.7%)        | 54(28.0%)        |      |     |
| Autumn                 | 42| 19(9.8%)        | 23(12.0%)        |      |     |
| Winter                 | 50| 12(6.2%)        | 38(19.7%)        |      |     |
| Accident place         |   |                 |                  |      |     |
| Home                   | 42| 09(4.7%)        | 33(17.1%)        | 15.474| 0.001|
| Residential area       | 37| 04(2.1%)        | 33(17.1%)        |      |     |
| Street                 | 72| 31(16.1%)       | 41(21.2%)        |      |     |
| Public place/others    | 42| 09(4.7%)        | 33(17.1%)        |      |     |
| Accident type          |   |                 |                  |      |     |
| Laceration             | 31| 02(1.0%)        | 29(15.1%)        | 26.280| 0.001|
| Fall                   | 60| 14(7.3%)        | 46(23.8%)        |      |     |
| Traffic accident       | 59| 30(15.5%)       | 29(15.1%)        |      |     |
| Blunt trauma/Others    | 43| 07(3.6%)        | 36(18.7%)        |      |     |

Cox and Snell $R^2$=0.304Nagelkerke $R^2$=0.440

Table 4. Association between in-hospital stage characteristics and hospitalization

| Hospitalization status | N | Hospitalization | Non-hospitalized | $x^2$ | p   |
|------------------------|---|-----------------|------------------|------|-----|
| Emergency treatment    |   |                 |                  |      |     |
| Stability assistance,  | 47| 11(5.7%)        | 36(18.7%)        | 13.124| 0.004|
| Cervical fixation,     | 34| 17(8.8%)        | 17(8.8%)         |      |     |
| Manipulation           | 46| 14(7.3%)        | 32(16.5%)        |      |     |
| Hemostasis/Others     | 66| 11(5.7%)        | 55(28.5%)        |      |     |
| Injury position        |   |                 |                  |      |     |
| Face                   | 36| 05(2.6%)        | 31(16.1%)        | 13.854| 0.003|
| Head/Neck             | 62| 12(6.2%)        | 50(25.9%)        |      |     |
| Limb/Pelvis           | 70| 30(15.6%)       | 40(20.7%)        |      |     |
| Chest/Abdomen/Body surface | 25| 06(3.1%)    | 19(9.9%)         |      |     |
| Final diagnosis        |   |                 |                  |      |     |
| fracture               | 26| 20(10.4%)       | 06(3.1%)         | 39.748| 0.001|
| Laceration             | 49| 06(3.1%)        | 43(22.3%)        |      |     |
| Sprain/ Bruise         | 60| 16(8.3%)        | 44(22.8%)        |      |     |
| Abrasion/others       | 58| 11(5.7%)        | 47(24.4%)        |      |     |
3.3 Association between In-Hospital Stage Characteristics and Hospitalization

The association between the in-hospital stage characteristics and hospitalization is presented in Table 4. As for emergency treatment, hospitalization was highly related to cervical fixation (8.8%) and non-hospitalization was highly related to hemostasis (28.5%), which was statistically significant (p<0.01).

As for injury position, hospitalization was highly related to the limbs and the pelvis (15.6%) and non-hospitalization was highly related to the head/neck (25.9%), which was statistically significant (p<0.01).

As for the final diagnosis, hospitalization was highly related to fractures (10.4%) and non-hospitalization was highly related to abrasions (24.4%), showing statistically significant differences (p<0.01).

3.4 Influencing Factor on Hospitalization

Logistic regression analysis was studied with accident season, accident place, accident type and emergency treatment, injury position and final diagnosis as independent variables, during hospitalization as a dependent variable [Table 5].

The result was as follows: logistic regression analysis resulted that there was no statistical significance in hospitalization depending on accident season, accident place and accident type, showing a statistic significance in hospitalization depending on emergency treatment and final diagnosis.

Specifically, patients who were treated with cervical fixation as emergency treatment, among other emergency treatment items at pre-hospitalization with the entire trauma patients, tended to more hospitalized than those who were treated with Stability assistance as emergency treatment, a higher probability of 15.49 (OR 15.492, CI 3.23-74.32), giving a statistical significance (p=0.001). It was found that emergency treatment such as stability assistance, manipulation, hemostasis/other were not a significantly influential factor on hospitalization.

For hospitalization due to the final diagnosis with the

| Table 5. Influencing factor on hospitalization |
|-----------------------------------------------|
| N     | %    | Hospitalization status |
| OR    | 95% CI | p     |
|-------------|----------------|----------------|
| Accident season |            |      |
| Spring       | 34       | 17.6 | 1 | - | 0.369 |
| Summer       | 67       | 34.7 | 0.49 | 0.13-1.77 | 0.273 |
| Autumn       | 42       | 21.8 | 1.28 | 0.34-4.80 | 0.715 |
| Winter       | 50       | 25.9 | 0.76 | 0.21-2.74 | 0.669 |
| Accident place |            |      |
| Home         | 42       | 21.8 | 1 | - | 0.793 |
| Residential area | 37 | 19.2 | 0.77 | 0.15-3.96 | 0.755 |
| Street       | 72       | 37.3 | 1.63 | 0.35-7.53 | 0.532 |
| Public place/other | 42 | 21.8 | 1.14 | 0.28-4.64 | 0.853 |
| Accident type |            |      |
| Laceration   | 31       | 16.1 | 1 | - | 0.607 |
| Fall         | 60       | 31.1 | 1.64 | 0.28-9.48 | 0.580 |
| Traffic accident | 59 | 30.6 | 4.07 | 0.45-36.55 | 0.210 |
| Blunt trauma/Other | 43 | 22.3 | 1.94 | 0.31-12.17 | 0.479 |
| Emergency treatment | |      |
| Stability assistance | 47 | 24.4 | 1 | <.001 |
| Cervical fixation | 34 | 17.6 | 15.49 | 3.23-74.32 | 0.001 |
| Manipulation   | 46       | 23.8 | 0.68 | 0.18-2.50 | 0.560 |
| Hemostasis/Other | 66 | 34.2 | 0.64 | 0.20-2.03 | 0.448 |
| Injury position |            |      |
| Face          | 36       | 18.7 | - | - | 0.304 |
| Head/Neck     | 62       | 32.1 | 1.20 | 0.29-4.98 | 0.803 |
| Limb/Pelvis   | 70       | 36.3 | 2.03 | 0.43-9.58 | 0.372 |
| Chest/Abdomen/Body surface | 25 | 13 | 0.49 | 0.07-3.27 | 0.462 |
| Final diagnosis |            |      |
| Fracture      | 58       | 30.1 | 1 | - | 0.186 |
| Laceration    | 26       | 13.5 | 4.91 | 1.18-20.41 | 0.028 |
| Sprain/Bruise | 49       | 25.4 | 2.62 | 0.67-10.25 | 0.166 |
| Abrasion/other | 60 | 31.1 | 1.85 | 0.49-6.96 | 0.361 |
| (Constant term) | 0.05 | - | - | 0.023 |
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entire trauma patients, those with fracture were more hospitalized than those with abrasion/other, a higher probability of 4.91 (OR 4.91, CI 1.18-20.41), showing a statistically significant difference (p=0.028). Besides, patients with laceration were more hospitalized than those with abrasion/other, 2.62 times (OR 2.62, CI 0.67-10.25), while patients with sprain/bruise were more hospitalized, a 1.85 times (OR 1.853, CI 0.49-6.96), with no statistical significance.

4. Discussion

In the association between the pre-hospital stage characteristics and hospitalization, they were more likely to be hospitalized in the fall due to accidents, which were more likely to occur on the street. They were more likely to be hospitalized due to traffic accidents.

In the association between the in-hospital stage characteristics and hospitalization, they were more likely to get emergency treatment with cervical fixation and were more likely to be hospitalized due to injuries in the limbs and the pelvis. The patients diagnosed with a fracture were more likely to be hospitalized. As for the factors affecting hospital treatment, they were about five times more likely to be hospitalized because of fractures than because of abrasions.

Suh et al. reported that frequent pre-hospital emergency treatments included limb fixation and cervical fixation. Seo reported that the limbs and the pelvis were more likely to be injured and that the frequent type of injury was a fracture. Kim et al. reported that the head/neck and the chest were more likely to be injured. Nam reported that the frequent type of injury was a fracture, which injuries were more likely to occur on the street and injuries were more likely to be caused by traffic accidents. On the basis of the data from Busan of 119 Fire Headquarters, Jo et al. reported that injuries were more likely to occur at home and on the street. Oh, and Sun et al. reported that injuries were more likely to occur due to driving accidents and slips. They may mostly agree with this study in terms of injury spots, injury types and causes of injuries. Of these, driving accidents can commonly occur; therefore, it is necessary to reinforce good publicity and education.

Lee et al. found that a cervical injury could lead to airway obstruction and Lee et al. reported that trauma patients might suffer from sleep deprivation and fear of death in emergency rooms (EMs). Jin et al. suggested the need to minimize side effects by developing indexes to assess the degree of pain promptly and objectively, by selecting and applying medicines and by giving an understanding. In other words, they emphasized the need to make efficient control and rapid treatment of traumatic pain.

Kim et al., who analyzed the quality of life-related to health for injury patients visiting EMs, reported that the quality of life-related to health was significantly improved over time. Kim et al. reported that surgery status and hospitalization duration could affect the quality of life-related to health for injury patients. Kim et al. and Kim et al. tried to help trauma patients lead a healthy life.

The injury types, the injury times and the causes of injuries in this study cannot be generalized to all the patients. To overcome this limitation, the following suggestions can be made: It is necessary to conduct analytical research on the association between the injury characteristics and hospitalization of trauma patients at the national level rather than at the regional level. It is necessary to make legal and institutional reinforcement for the association between the injury characteristics and hospitalization of trauma patients. It is also necessary to develop prevention programs with the aim of reducing injuries for trauma patients.

This study has the following limitations: First, emergency treatment activity journals of 119 rescue teams in U Metropolitan City were used; second, medical records in the emergency medical center of a single hospital were reviewed; third, data collection and analysis was confined to the year of 2013; and fourth, it was confined to a region. Care should be taken to generalize the results of this study.

5. Conclusion

According to the result of the study, the type of injury and the characteristics of accidents were complicated and varied. So, it is suggested that speedy 119 service and improved emergency treatment lead to the higher prognosis of trauma patients, while hospital-connected system was encouraging the prevention of injury. Also, more concrete and multi-dimensional plans should be devised, such as encouraging the importance of trauma, establishing policy for preventing injury and reducing trauma patients and preparing the base data. Additionally, cultivating more matured civic consciousness will be helpful for minimizing injury, with a continuous
monitoring, prevention. PRs. Above all, it is a requisite that new prevention plans for injury should be backed with the legislative or institutional maintenance.

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