国士舘大学審査学位論文

「Retrospective Evaluation of clinical effectiveness of trauma field triage by the EMT」

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学 位 の 種 類	博士（救急救命学）
報　告　番　号	甲　第４４号
学位授与年月日	平成２８年3月２０日
学位授与の要件	学位規則第４条第１項該当
学 位 論 文 題 目	Retrospective evaluation of trauma field triage by the EMT
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博士論文

Retrospective evaluation of trauma field triage by the EMT

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Fiscal 2015 Doctoral Thesis

Retrospective Evaluation of clinical effectiveness of trauma field triage by the EMT.

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CONTENTS

abstract

Background: Determinations of severity and criticality trauma infield triage (Load and Go: L&G) by an EMS crew are consist 1. Mechanism of injury, 2.physiological assessment, and 3.survey for of whole body anatomical injury, and it is thought that it is optimal an appropriate ***'right time'***, ***'right place'***, ***'right patient'***, transport to trauma canter according to these observations. However, there are few reports found that compare the L&G determination by the EMS crew with the final diagnosis of injury or prognosis on the hospital.

Objective: To Evaluated medical usefulness of pre-hospital trauma field triage data recorded by the local EMS linked with in-hospital trauma data.

Methodology: A level III retrospective cohort study was conducted. Among 6,677 traffic in juries patients were enrolled between January 1, 2011 and December 31, 2011. 892 cases that were subjected moderate or higher severity and transported to *C* Trauma and Critical Care Canter, Further, multivariable logistic regression analysis was conducted with mechanical injuries, field assessment, severity and trauma outcome at the hospital, such as probability of survival and ISS, used as primary endpoints.

Result: The determination of L&G by the EMS crew to *C* Critical Care Centre indicated over-triage. The positive predictive value of severe cases compared to L&G was 93%, while the negative predictive value was 21%, and even among the high ISS group (ISS 15 or higher), the chance for survival was high at 0.8±0.3 (sensitivity 0.20, specificity 0.93). Further, the L&G determination through initial assessment by EMS crew indicated an anatomical severity of ISS 15 or higher, and a high odds ratio of 12.99 (95%CI: 4.94–34.69). Among the 7 mechanism of injury, as expected, patients flew more than 5 m distance by the hit a car indicated high ISS and with a odds ratio of 2.97(95%CI: 1.35-6.50).

Conclusion: While the initial assessments by EMS crew more illuminate to appropriate decision of trauma severity, it still be necessary to improve observation skills for EMS crew in the future re-education. Our preliminary results indicates that prehospital and in-hospital data should be analysed with connect for more detail analysis of prehospital care provider performance.

Introduction

Due to the post-war population increase in the number of vehicle owners in Japan, the country marked increase in traffic related deaths, sometimes termed the "traffic war," with the annual number of traffic related deaths exceeding 15,000 in the 1970s. Subsequently, to improve road safety, including the construction of right turn lanes, police enforcement including stricter penalties for drunk driving, which is particularly linked to serious and fatal accidents, and a toughening of the Road Traffic Law to mandate the use of child seats and the like, and vehicle safety measures on the part of motor vehicle manufacturers (seat belts as standard equipment, air bags, GOA bodies, etc.), the number of deaths from fatal traffic accidents in Japan in 2014 was reduced to 1/3rd of what it had been in the 1970s[1)].

In parallel, the creation of an emergency care system was initiated in the 1970s, including the creation of tertiary critical care and emergency medical centers and the expansion of the primary and secondary emergency care system, over 250 critical care and emergency medical centers having been formed currently for the secondary medical care field. Going into the 2000s, Japan's trauma care system improved at an accelerated pace, with training of emergency medical care specialists and trauma specialists by the Japanese Association for Acute Medicine and the Japanese Association for the Surgery of Trauma, establishment of trauma registries such as the Japan Trauma Data Bank (JTDB), and more hospitals operating EMS Doctor onboard helicopter(as Doctor Heli) and non-transporting EMS vehicles(as Doctor car)system. Within the trauma-related clinical education system, through the establishment of JPTEC™ (Japan Pre-hospital Trauma Evaluation and Care) for initial prehospital trauma evaluation and care by EMS personnel and JATEC™(Japan Advanced Trauma Evaluation and Care) for use in hospitals, the concepts and language used by ambulance personnel and medical staff involved in trauma care have become unified, and the development of a common set of concepts along with standardized education has been carried out nationwide since 2003.

As a result, because the JPTEC™ Council (JPTEC is a trauma care and evaluation standard for EMS personnel) started its activity, so far, over 1,000 JPTEC providers have been trained per year, and EMS personnel who evaluate trauma patients before they reach a hospital have rapidly improved their decision-making ability and quality of care. Improvements have been achieved in particular with regard to evaluation of trauma patients by EMS crews nationwide, especially as regards trauma field triage for determining severity and urgency and techniques for care during transport[2)3)].

In particular, as regards the field triage of trauma by ambulance personnel performed when an ambulance crew is dispatched to the scene of a traffic accident, after various sorts of deliberation by regional medical control (MC) councils and the like, the trauma field triage method specified in JPTEC™ has become established as standard in Japan. The concept of trauma field triage involves making what JPTEC™ refers to as the load and go (L&G) decision, in which severity and urgency are determined. L&G consists of three elements: scene size-up (SS: Scene Size Up), in which the possibility of high energy trauma is determined based on the mechanism of injury, initial assessment (IA: Initial Assessment), which involves criteria for evaluating systemic circulation and physiological indicators through rapid vital sign measurement and the like, and rapid trauma survey (RTS: Rapid Trauma Survey) in which the head to toe whole body examination and anatomical survey that could lead to early death is identified. Based on the results of this, the patient would be optimally transported to a secondary emergency medical facility or trauma treatment facility or to a tertiary emergency medical facility, depending on the regional trauma treatment system[4)5)6)].

At critical care and emergency medical centers and trauma treatment facilities that accept trauma patient's nationwide, trauma registries have been created and medical staff education has been carried out to enable trauma diagnosis and treatment based on JATEC™ in order to improve the quality of trauma diagnosis and treatment. JTDB [7)] was created for the purpose of widely collecting and analyzing data on trauma patients and providing feedback on the results to medical facilities. However, in-hospital trauma data have contained very limited prehospital fiend triage and the decisions or treatments performed by ambulance personnel.

Based on our search, there have been few publications so far that have attempted to verify if the L&G decisions and trauma field triage performed by EMS personnel at the scene of trauma emergencies in Japan are correlated with the outcome after transport to hospital and with in-hospital indicators of trauma severity such as Probability of Survival (Ps), Revised Trauma Score (RTS), Injury Severity Score (ISS)[4)5)6)8)]. It would be connect for both pre-hospital and in-hospital treatment and outcomes, and to perform a detailed analysis regarding the appropriateness of pre-hospital decisions such as trauma field triage decisions and treatments performed by ambulance teams on the basis of in-hospital outcomes for the trauma patients.

Purpose

This study links and comparatively investigates pre-hospital data on traffic injuries recorded by local fire agency and in-hospital patient data recorded at critical care and emergency medical centers, and retrospectively examines the medical efficacy of field triage based on mechanism of injury, initial assessment and rapid trauma survey from the standpoint of trauma field triage and anatomical severity recorded after transport to hospital.

Study method

Study regions: Three fire department D, E and F in region B of prefecture A will be dealt with in this study. According to the 2013 Annual Fire Department Report, region D was reported to have a population of 156,000, an area of 159 square kilometers, 8 ambulances, 52 active emergency life-saving technicians, and 6,008 ambulance dispatches for the year. Region E had a population of 271,000, an area of 197 square kilometers, 13 ambulances, 72 active emergency life-saving technicians and 11,639 ambulance dispatches for the year. Furthermore, Region F had a population 49,000, an area of 49 square kilometers, 3 ambulances, 13 active emergency life-saving technicians and 2,031 ambulance dispatches for the year. Traffic injuries accounted for 13% of all transported patients. The ambulance crews in these three fire department included 50% or more JPTEC™ providers who had studied trauma triage, and their techniques were essentially standardized.

Furthermore, critical care and emergency medical center C, which was the receiving institution for the trauma patients in this study, satisfied all 10 of the conditions stipulated in the "Suggestions concerning the organization of trauma centers in Japan" provided by the Japanese Association for the Surgery of Trauma, being a specialized trauma treatment facility capable of handling the diagnosis and treatment of head, torso, pelvis and limb trauma 24 hours a day, 365 days per year, with 20 full time emergency care physicians and its disposal as well as 8 registered trauma specialists. The facility also initiated Doctor Helicopter EMS service (HEMS) since 2001, which has been active within A Prefecture as well in the southern part of other prefecture.

Study patients selection: Out of the 6,677 emergency dispatches for traffic injuries that occurred in the area of responsibility of B-Medical Control(as MC) Council, to which Fire Department D, E and F of prefecture A belong, in the period from January 1, 2011 to December 31, 2013 and for which an emergency activity record sheet was filled in by the Fire Department, 5,455 cases of mild severity were eliminated, and out of the remaining 1,222 traffic injury patients of moderate or higher severity, 892 patients who were transported to critical care and emergency medical center C were extracted and used to conduct a retrospective cohort study.

Inclusion criteria: First, the parameters shown in Table 1 were extracted from the emergency dispatch data (emergency activity record sheets) possessed by the three fire department D, E and F and were linked with the in-hospital trauma data recorded by critical care and emergency medical center C of B region MC to create trauma patient record forms. An analysis was the conducted according to the following procedure.

1. Out of the 892 patients transported to C critical care and emergency medical center, 316 patients with a missing value for any of the parameters, 37 patients who were in cardiac arrest upon arrival at the ER and 18 patients with severe head trauma of AIS 6 or higher, or a total of 371 patients, were excluded, and the remaining 521 patients were taken as subjects (Figure. 1).

2. The 521 subject patients were classified based on the ambulance crew's decision as L&G-yes (n=425) or L&G-no (n=96), and the L&G-yes cases were further classified based on in-hospital outcome as severe and higher (n=86) or moderate and lower (n=339). First, the specificity, sensitivity, positive predictive value and negative predictive value were calculated for L&G decisions made by ambulance crews.

3. For the 521 subject cases, multivariate logistic analysis was performed on the mechanism of injury (significant deformation of the vehicle, thrown more than 5 m, large distance between overturned motorcycle and driver, overturned vehicle, occupants ejected from vehicle, run over by vehicle, rescue took 20 minutes or more, etc.) used in the scene size-up as recorded by the ambulance crew and severe cases of ISS 15 or higher based on ISS obtained after hospitalization, in order to study what mechanisms of injury contributed to the development of severe cases.

4. The 521 subjects were classified as L&G (n=425) or no-L&G(n=96) based on the decision of the EMS crew, and the mechanism of injury and the stage at which the L&G decision was made by the ambulance crew in the course of the activity at the trauma scene (SS, IA, RTS) were studied; furthermore, the subjects were classified according to the injury severity score assessment (ISS 16 or higher, ISS 15 or under ~~lower~~) based on the trauma anatomical and physiological assessment by physician at time of diagnosis on the critical care and emergency medical center, and the patient outcome, provability of survival (Ps), revised trauma score (as RTS) and ISS and other parameters indicating the in-hospital data were taken as primary endpoints to perform logistic regression analysis.

Submission of study for ethics committee review: Before conducting this study, the study protocol was submitted for review to the Kokushikan University Ethics Committee and received approval (approval number 13-DJ003). The purpose of this study was explained in writing to the fire brigades and regional MC that cooperated with the study, a written request for cooperation with the study was submitted to the B-MC Committee of prefecture A, and the study was conducted after obtaining permission from the MC Committee chairman and the chiefs of each of the fire brigades. The study protocol and a written request were also submitted to the critical care and emergency medical center of hospital C, and cooperation was obtained with the permission of the ethics of committee of hospital C. All name data was removed from the personal information of patients and efforts were made to protect personal information.

Statistical analysis: A Microsoft® Excel® pivot table was used as the data collection method. Columns that were without a response or empty were treated as missing values. Statistical testing of the obtained data was performed according to the following procedure. The data obtained in the study was subjected to simple tabulation and cross tabulation, and comparison was performed between the two groups. Numerical data was represented as mean±1S.D. and was tested using unpaired t-test and Fisher's exact test. Furthermore, for the cross tabulation, a chi-square test was performed and P value less than 0.05 was treated as significant difference. In addition, multivariate logistic regression analysis was conducted using JMP from SAS. Taking severity determination of ISS>15 at time of initial care as the primary effect and age, sex, time interval to arrival on scene, time spent on scene, and time interval from notification to arrival at hospital as the shared parameters, the odds ratio and 95% confidence interval were calculated.

Results

1. Pre-hospital L&G decision and in-hospital outcome

The number of traffic accidents in the study regions was 6,677 incidents. These include 1222 incidents with a patient for whom the emergency life-saving technicians made an L&G decision and 5,455 instances (81.6%) of non-L&G. Furthermore, among the 1,222(18.3%) instances of transport to a tertiary critical care and emergency medical center, transport to emergency and critical care center C based on a determination of severe or moderate case took place in 892 instances (73%). After eliminating 371 of these patients who matched the exclusion criteria (316 patients with missing data, 37 patients with cardiopulmonary arrest on arrival and 18 patients with AIS>6), the in-hospital severity determination for the remaining 521 cases was examined. Among the L&G patients, 86 patients were judged to be severe as ISS more than 15 (ISS≧15) and 339 patients were judged to be moderate as ISS up to 15(ISS<15), for a total of 425 patients, while among the 96 non-L&G patients, 90 were judged to be moderate and 6 were judged to be severe.

Extracting the sensitivity and specificity based on the ambulance team's L&G decision and the in-hospital severity determination, the sensitivity was 0.20, the specificity was 0.93, the positive predictive value was 0.93 (95%CI 0.87–0.96) and the negative predictive value was 0.210 (95%CI 0.19–0.21), revealing a tendency toward over-triage (Table 2).

2. Patients Background.

The basic background of the 521 trauma patients transported to critical care center C is shown (Table 1). There were 425 L&G(+)s patients and 96 L&G(-), and the 425 L&G(+) patients were further classified into severe(ISS≧15) and moderate(ISS<15) based on injury severity score determination, and the various parameters and the L&G decision criteria were studied another.

In the L&G(+) severe ISS group(ISS≧15), the time spent on scene was significantly (0.5 min) longer than in the moderate groups(ISS<15), and in terms of pre-hospital vital signs, the severe ISS group showed a tendency toward tachypnea, tachycardia, low systolic blood pressure and lowering of consciousness. Furthermore, it was found that 44.1% of these patients had a GCS of 13 or lower, is significantly higher than the 10.1% for the moderate cases (Table 1).

Furthermore, the mean ISS in the L&G(+) severe ISS group were 29.1±13.7, RTS 6.9±1.4, and Ps 0.8±0.3, were significantly higher than in the moderate ISS group, while mean ISS are 6.2±3.7, RTS 7.7±0.4 and mean Ps, at 1.0±0.03, were found to be significantly lower than in the moderate group.

We found that AIS, which shows the anatomical severity, was significantly higher in the severe group as compared to the moderate group with head, abdomen, limbs and pelvis.

Detailed investigation of pre-hospital L&G and patient prognosis, the stage at which the L&G decision was made by the ambulance crew was studied by dividing into SS group, IA group and RTS group based on the time of decision. Among the 425 cases where L&G was applied, the L&G decision was made in 67 cases (15.8%) in the IA group, of which 36 cases (41.9%) were severe ISS and 31 cases (9.1%) were moderate. Conversely, the decision was made during RTS in 138 cases (32.5%), of which 29 cases (33.7%) were severe ISS while 109 cases (32.2%) were moderate ISS.

3. Investigation of relationship between mechanisms of injury and ISS

Table 3 and Fig2 show the results of detailed classification and investigation of mechanisms of injury. The mechanism of injury indicated in JPTEC is the mechanism of injury described in detail in the data recorded by the fire department. In this study, we investigated the relationship between the detailed mechanism of injury and ISS, which indicates anatomical severity (Table 3 and Fig2).

In particular, among the 165 instances of vehicle versus vehicle type traffic accidents (including trucks and buses), there were 58 accidents (35.2%) at an intersection, 31 (18.8%) head-on collision accidents (including offset collision), 32 (19.4%) rear end collisions and 7 (4.25%) overturning accidents. Among the 165 vehicle versus vehicle traffic accidents, an L&G decision was made in 125 cases (75.7%), of which 20 (16%) were cases where ISS was 15 points or greater (ISS≥15). In terms of mechanism of injury in cases of where an L&G decision was made, among accidents within an intersection, 3 cases (7.5%) were ISS≥15; among head-on collision accidents, 6 cases (20.6%) were ISS≥15; among rear end collision accidents, 6 cases (28.5%) were ISS≥15; and among overturning accidents, 0 cases (0%) were ISS≥15. Cross tabulation was performed for comparative study of L&G, ISS and mechanism of injury, which revealed that in vehicle versus vehicle as opposed to person versus vehicle traffic accidents, the likelihood of L&G was higher and there was significantly greater likelihood of ISS≥15 points as well as higher anatomical severity ($p<0.05$). In terms of other parameters, there were no mechanisms of injury that showed a significant difference with respect to severity of trauma (Table 3).

Multivariate logistic analysis was performed on analyzed mechanism of injury. The results showed that when adjusted odds ratios were generated using ISS related factors (age, sex, time spent on scene, etc.) as co variables, being thrown 5 m or more was the only indicates strongly correlated and between mechanism of injury ISS≥15 (Fig2).

4. Investigation of the appropriateness of L&G decisions made by a EMS crew

Multivariate logistic regression analysis was performed on L&G decisions by EMS crews in terms of whether the decision was made during initial assessment, rapid trauma survey or scene size-up, versus the discrimination of severe/moderate using ISS≥15,or ISS<15 which indicates the anatomical severity, as an outcome. Furthermore, age, sex, time interval to arrival on scene, time spent on scene and time interval from notification to arrival at hospital, as indicators that affect the outcome, were employed as co variables. The results showed that, for anatomically severe cases with ISS≥15 as compared to less severe cases, the respective value was higher for initial assessment, at 12.99 (95% CI: 4.94–34.64), and was 1.40 (95% CI: 0.60–3.16) for scene size-up (Fig3).

Discussion

In this study, we found that the initial assessments by EMS crew more illuminate to appropriate decision of trauma severity, it still be necessary to improve observation skills for EMS crew in the future re-education.

Also, it has been amply demonstrated during over the course of the past 10 years that initial treatment of trauma has been able to reduce the number of preventable trauma deaths Preventable Trauma Death, (as PTD) through education and system construction involving the unification of concepts and language between pre-hospital and in-hospital trauma care through various standardized education approaches such as JPTEC™. However, the number of traffic accident injuries remains high, involving 711,374 persons, including 41,658 serious cases, in 2014, and traffic accidents remain the leading cause of sudden death among youth, which is something that cannot be ignored[1].

Kitagawa et al collected data on pre-hospital care by having critical care and emergency medical centers ask ambulance crews to fill in a prepared form when transport patients to the critical care and emergency medical center. Their study compensated for the shortcomings in data parameters collected in-hospital and also showed how important pre-hospital care information is[8]. However, their method has the problem that it only deals with data from particular facilities, which is also a limitation of our study. The patients transported to the critical care and emergency medical center came only from certain Fire Department, ther for matching the cases with in-hospital data was very difficult. In the case of medical facilities that have adopted in-hospital trauma data, it is possible to discover cases of preventable trauma death (PTD) , but when the patient is transported to other facilities, getting post-admission trauma information becomes very difficult. Thus, I think that it is necessary to have a trauma registry version of Utstein Style, which would allow trauma cases nationwide to be studied based on the same format from the pre-hospital care stage. While the study that we conducted here is a pilot study, by taking the information obtained by ambulance teams at the pre-hospital stage, which was being provided in the time of Transport to hospital, and linking this pre-hospital information with in-hospital trauma data at the regional MC level, we have been able to verify the appropriateness of L&G decisions made by ambulance teams using clinical outcome and in-hospital trauma severity as outcomes.

A new finding of this study was that L&G decisions made by ambulance teams during initial assessment showed a high odds ratio of 12.99 (95% CI:4.94-34.64) with respect to anatomical severity of ISS≥15. Among mechanisms of injury, being thrown 5 m or more showed a high odds ratio in relation to ISS. On the other hand, it was found that when scene size-up was used for the L&G decision, the correlation and odds ratio with respect to anatomical severity and clinical outcome were low. Furthermore, we were able to ascertain that improvement of ambulance crew L&G decision-making, especially of evaluation capability for IA, plays an important role in preventing PTD at the pre-hospital stage. In particular, with regard to decisions on the presence of abnormalities in the IA, we think appropriate decisions regarding patients with trauma-induced hemorrhagic shock (hereafter, shock) were a critical factor here. Currently, due to the extension of the scope of practice, emergency life-saving technicians are able to provide intravenous therapy to patients in shock, so improving the ability to recognize shock during IA is extremely important. The L&G decision-making criteria of JPTEC™ stipulate that the L&G decision should be made in the sequence of IA, followed by RTS, and finally SS. With regard to SS, as stated in the Introduction, the occupant protection performance of vehicles has improved, and when the vehicle is dented to a certain extent, the engine and gearbox serve as robust reinforcing elements that protect the vehicle occupants. Thus, as vehicle safety has improved more and more, L&G decisions based on the determination of high energy accidents previously made during SS have become inapplicable, which we think is one factor for why there was no significant difference in this study with regard to severe trauma in accidents involving vehicle versus vehicle collision as a mechanism of injury.

Furthermore, with regard to L&G decisions based on RTS, as seen in the reports by Yamanoue[6] and by

Kitagawa et al[8], it seems that RTS does not show a significant difference in terms of correlation with severity as compared to IA. It is hard to ascertain the cause of this, such as if this is due to inadequate evaluation techniques and knowledge for RTS on the part of ambulance crews. In education for ambulance personnel, one learns about the normal organism and then acquires knowledge and techniques for detecting abnormalities. However, unlike with physicians, even if ambulance crews are given instructions on conditions such as flail chest, subcutaneous emphysema and pelvic fracture, from the standpoint of an ambulance crew, these are trauma conditions that they may encounter once in the course of several years, and however many films or trauma models may be used, the actual case experience will be lacking. We think this is an issue for future trauma education[9][10][11].

In this study, L&G decisions made by ambulance crews had a sensitivity of 0.20 and specificity of 0.93 from the standpoint of emergency activity records data for C, D and F, leading to the assessment that transport to critical care and emergency medical center C involved over-triage. This reflects the characteristics of the regions studied. Namely, the B region MC Council admit that there is over-triage of trauma in this region, which reflects the readiness of hospitals to receive patients and indicates that a system has become established whereby ambulance crews, if they have any doubt, transport the patient without hesitation to a critical care and emergency medical center, which is better at dealing with trauma. The fact that the PTD rate at critical care and emergency medical center C is less than 3% also speaks to the excellence of the trauma diagnosis and treatment system of the institution as a whole. It has been reported that for field triage of trauma in USA ~~Japan~~, over-triage of 35–60% and under-triage of up to 50% are considered acceptable[13], so the fact that nearly all cases of transport in this study involved over-triage may be viewed as a limitation of this one study.

In-hospital data has so far not included detailed data on whether the L&G decision based on IA involved airway, respiratory or circulatory abnormalities The anatomical abnormalities based on RTS were located, or on the mechanism of injury based on which the L&G decision was made during SS, and not just the ambulance crew's L&G decision. Thus, trauma data analysis and analysis of pre-hospital evaluation and care were not made an object of the study. Fire Department that retain L&G records as data in their ambulance crew emergency activity records, which were the object of our study here, are still few in number when considered nationwide. In future, obtaining more detailed pre-hospital data when a patient is transported to hospital will make it possible to improve the pre-hospital decision-making of ambulance crews. In addition, while traffic accident related deaths have decreased, with the increasingly ageing society that we have now and the higher accident rates among the elderly, it is necessary to strategically and continually obtain pre-hospital trauma data also for use in education.

For further improvement of trauma registries, it is essential to include on-scene data from ambulance crews, data on whether an L&G decision was made during initial assessment, and records on airway abnormalities, respiratory abnormalities and circulatory abnormalities during IA. Furthermore, with regard to RTS, there is a need for concrete information on whether an L&G decision was made, followed by the locations of anatomical abnormalities. Moreover, for SS, parameters need to be added to the pre-hospital section including whether an L&G decision was made, followed by information leading up to the mechanism of injury or contact, including (1)ejection from vehicle, (2)death of fellow occupant, (3)significant vehicle body deformation, (4)overturning of vehicle, (5)fall from height, (6)over 20 minutes until rescue, (7)high speed, (8)struck by vehicle, (9)run over by vehicle, (10)large distance from vehicle, etc. Another task to be addressed is how to publicize the significance of data collection to fire brigades and how to work toward adoption of a trauma version of Utstein Style.

Limitations of the study

• Retrospective study.

• This study dealt with a hospital having a well-developed trauma diagnosis and treatment system and with fire brigades that have had ample trauma training

Since the acceptable rate of over-triage for hospitals is high, transport to a critical care and emergency medical center was selected in cases where the ambulance crew on scene was unsure about the field triage

Conclusions

Emergency activity records data and hospital trauma data were combined to retrospectively investigate L&G decisions. The ambulance crews practiced field triage based on JPTEC™, and the L&G decisions to transport to a critical care and emergency medical center showed over-triage. The positive predictive value of L&G decisions for severe cases was 0.93, the negative predictive value was 0.21, and Ps was high at 0.8±0.3 even for severe cases (sensitivity 0.38, specificity 0.95). Furthermore, L&G decisions made by ambulance crews based on initial assessment showed a high odds ratio of 12.99 (95% CI:4.94-34.64) for anatomical severity of ISS 15 or higher. Among mechanisms of injury, being thrown 5 m or more showed a high odds ratio in relation to ISS(2.97(95%CI:1.35-6.50)).

While the initial assessments performed by the ambulance crews showed good discrimination of trauma severity, it is necessary to continue with efforts to improve evaluation capabilities. Current in-hospital trauma data has missing parameters relating to the pre-hospital stage, and the addition of detailed data parameters on initial assessment, rapid trauma survey and scene size-up decision-making criteria and treatments is necessary.

Acknowledgements

In concluding this paper, we thank all the ambulance crew and fire brigade personnel who entered the data used in this study.

We also thank Professor Hisashi Matsumoto of the Nippon Medical School Chiba Hokusoh Hospital and all the medical personnel who provided us with in-hospital data and guidance.

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Table 1 Characteristics of patients background

		L&G(+)			L&G(-)
		L&G (+) All case	ISS≧15	ISS<15	
		n=425	n=86	n=339	n=96
Age (Year)		43.3±21.5	48.3±23.1	42.1±20.9	40.5±21.1
Gender (Male%)		823 (66.6)	61 (70.9)	222 (65.5)	67 (69.8)
Time					
Response time		9.4±4.5	9.8±3.8	9.3±4.6	10.1±3.9
Scene stay time		16.4±7.8	15.5±8.0	16.6±7.8	20.7±7.9
Scene to Hospital time		15.5±12.1	15.2±11.3	15.6±12.3	10.9±10.0
119-Hospital arrival		41.2±15.7	40.5±15.1	41.3±15.8	41.6±12.0
L&G					
Initial Assesment (%)		67 (15.8)	36 (41.9)	31 (9.1)	N.A.
Rapid Trauma survey (%)		138 (32.5)	29 (33.7)	109 (32.2)	N.A.
Scene size up (%)		257 (60.5)	33 (38.4)	224 (66.1)	N.A.
Vital sign(Prehospital)					
RR(r/min)					
<10		4 (0.9)	1 (1.1)	3 (0.9)	1 (1.0)
≥30		78 (18.4)	27 (31.4)	51 (15.0)	9 (9.4)
HR(r/min)					
<50		7 (1.6)	1 (1.2)	6 (1.7)	0 (0.0)
≥100		81 (19.1)	30 (34.9)	51 (15.0)	12 (12.5)
SBP(mmHg)					
<90		14 (3.3)	12 (14.0)	2 (0.6)	1 (1.0)
≥160		97 (22.8)	12 (14.0)	85 (25.1)	23 (24.0)
GCS					
3-8		19 (4.5)	15 (17.4)	4 (1.2)	0 (0.0)
9-13		53 (12.5)	23 (26.7)	30 (8.9)	6 (6.2)
14-15		353 (83.1)	48 (55.8)	305 (90.0)	90 (93.8)
AIS					
3≧Head & Neck	114	1.6±1.3	2.6±1.6	1.3±1.1	1.0±1.1
3≧Face	7	0.1±0.5	0.2±0.7	0.1±0.5	0.1±0.4
3≧Chest	109	1.1±1.5	2.8±1.7	0.6±1.0	0.5±1.0
3≧Abdominal	40	0.4±1.0	1.2±1.7	0.2±0.6	0.1±0.6
3≧Spinal	47	0.7±1.1	1.2±1.5	0.5±0.9	0.6±0.9
3≧Extremity	5	0.3±0.7	0.3±0.8	0.3±0.7	0.3±0.7
ISS		10.8±11.6	29.1±13.7	6.2±3.7	5.4±5.2
Rivised Trauma Score (RTS)		5.7±0.8	6.9±1.4	7.7±0.4	7.7±0.3
Provability of survival (Ps)		0.9±0.1	0.8±0.3	1.0±0.03	1.0±0.02

ISS(Injury Severity Score) ,L&G(Load and go),RR(Respiratory rate), HR(Heart rate),
GCS(Glasgow Coma Scale),SBP(Systolic blood pressure), Abbreviated Injury Scale(AIS),

table 2 Sensitivity speciffcity of L&G and patients severty

	L&G	no-L&G	Total
ISS≧15	86(20.2%)	6(6.3%)	92
ISS<15	339(79.8%)	90(93.8%)	429
Total	425(100%)	96(100%)	521

$p<0.001$ OR:3.80(CI:1.61-8.98)

Sensibility:0.20(CI:0.18-0.21)

Specificity:0.93(CI:0.87-0.96)

Positive preditable value:0.93(CI:0.87-0.96)

Negative predictable value:0.21(CI:0.19-0.21)

Table3 Relationship between Mechanism of injury, L&G and ISS due to traffic accident

Accident type	Vehicle type	Detail of accident	Accident Total	L&G	ISS <15	ISS ≧15	P value
Car -to- Car accident	Truck and bus incl.		165	125	105	20	-
		Cross section	58	40	37	3	
		Head-on collision	31	29	23	6	
		Rear-end accident	32	21	15	6	
		Rollover acciden	7	5	5	0	
		Others	37	30	24	6	
Car -to- Pedestrian accident (Truck and Motorcycle incl.)			86	72	59	13	0.6974
Multiple car accidents			9	5	3	2	0.2925
		Rear-end accident	7	5	4	1	
		Others	2	0	0	1	
Pedestrian accident	Car -to- Pedestrian accident (Truck and Motorcycle incl.)		84	71	42	29	0.0003
		Cross section	32	28	22	6	
		Rear-end accident	6	6	5	1	
		Others	46	37	15	22	
Bicycles and car accident			69	56	43	13	0.298
		Cross section	13	10	9	1	
		Rear-end accident	9	6	6	0	
		Head-on collision	1	1	1	0	
		Others	46	39	27	17	
Motorcycle and Vhiecle accident (Truck incl.)			89	61	44	17	0.0774
		Cross section	29	22	18	4	
		Others	60	39	26	13	
Bycycle and Bycycle accident (incl Pedestrian)			7	5	3	2	0.1987

The ISS 15 or more with respect to the car accident.With respect to less than ISS 15, we went to test it other items.

It was on the basis of the accident between cars in relation to less than ISS 15 or more.Car alone accident, car multiple accident, pedestrian accident, bicycle and car,
Cars, motorcycles, bicycles and bicycle Each item went the test.Fisher's exact test.

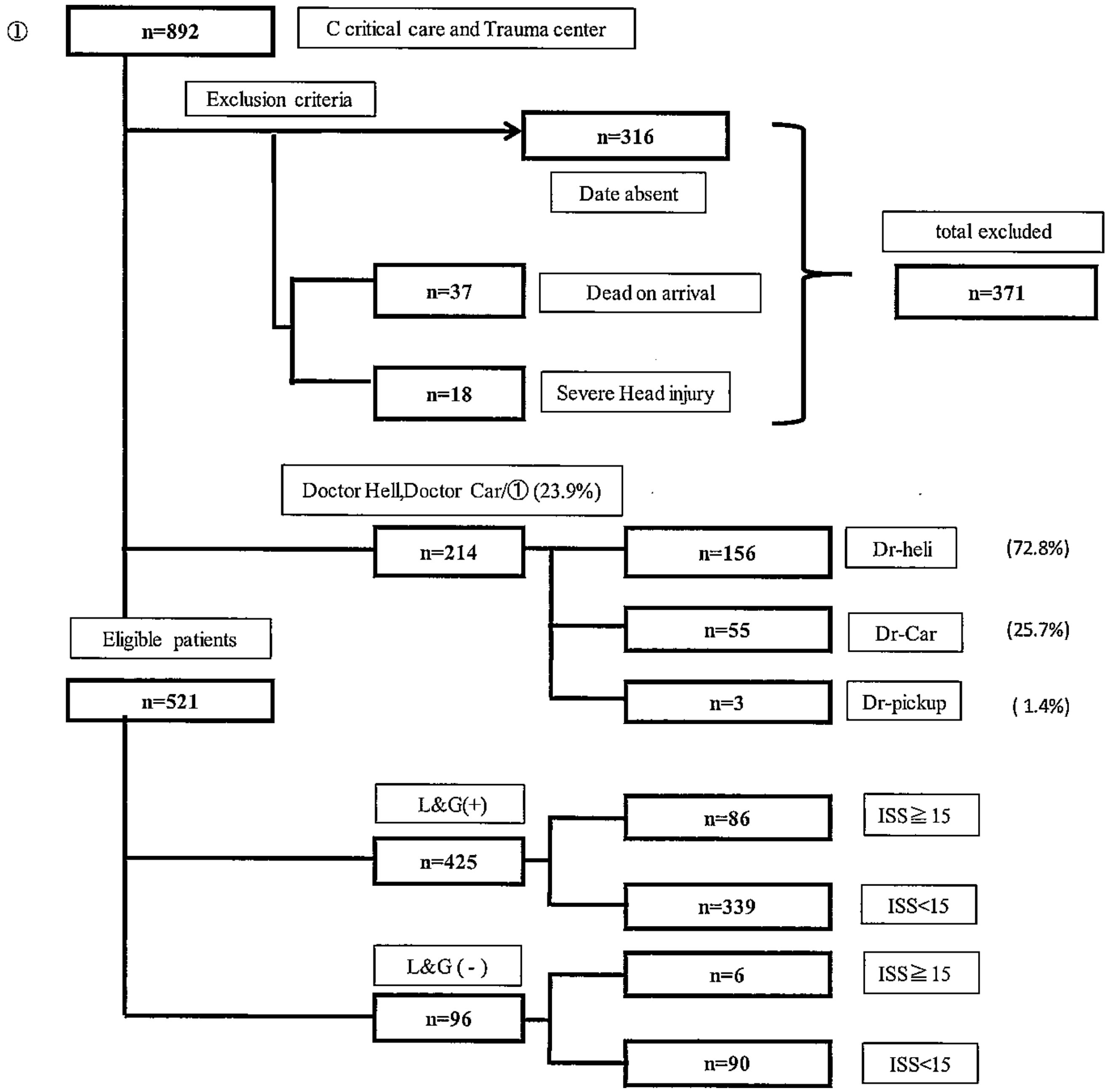


Fig1. Patients selection flow (jan 1. 2011-Dec 31.2013)

Mechanism of injury	Adjusted Odds ratio (95%CI)	Odds Ratio	(95%CI)
Severe defromity of vehicle		1.03	0.57-1.86
Collision of vehicle and pedestrian・bycycle		1.62	0.82-3.17
Flew more than 5m distance hit by car		2.97	1.35-6.50
More than 5 m distance btween Motor cycle and driver		2.26	0.93-5.35
Rollover accident・Roll over of Viecle		0.97	0.35-2.39
Runover by vehicle		1.55	0.46-4.61
Ejection form vehicle		0.85	0.04-6.13
More than 20min to rescue from vehicle		2.41	0.55-9.16

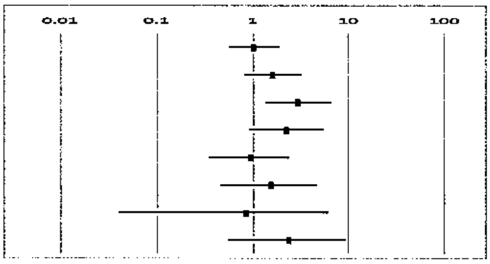
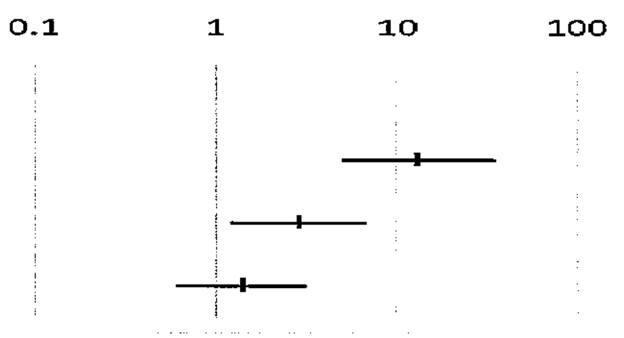


Fig 2 Factors related to mechanism injury and Injury severity score

Decision of L&G	Adjusted Odds ratio (95%CI)	Odds ratio	95%CI
ISS≥15			
Initial Assesment		12.99	4.94-34.64
Rapid trauma survey		2.90	1.19-6.82
Scean Size Up		1.40	0.60-3.16



AOR refar to Initial assesment, Rapid Trauma Survey , Scean Size up negative pattients

Fig 3 Multivariate logistic regression analysis : Factor associated with ISS, Patients severity and L&G decision