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GASTROENTEROLOGY

# Blatchford scoring system is a useful scoring system for detecting patients with upper gastrointestinal bleeding who do not need endoscopic intervention

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**Key words**
Blatchford score, emergency endoscopy, upper gastrointestinal bleeding.

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## Abstract

**Background and Aim:** Several scoring systems have been devised to identify patients with upper gastrointestinal (UGI) bleeding who are at a high risk of adverse outcomes. We retrospectively evaluated the accuracy of the Blatchford scoring system for assessing the need for clinical intervention in cases of UGI bleeding admitted to the emergency department (ED).

**Methods:** This was a retrospective study conducted on patients who underwent emergency GI endoscopy at the ED of our hospital. Those who needed blood transfusion, operative or endoscopic interventions to control the hemorrhage were classified into the 'high risk' group.

**Results:** Of the 93 enrolled patients, 70 (75.3%) were classified into the high risk group. The Blatchford score was significantly higher in the high risk group than in the low risk group. When a cut-off value of 2 was used, the sensitivity and specificity of the Blatchford scoring system were determined to be 100% and 13%, respectively. Thus, the Blatchford scoring system was deemed to be useful for distinguishing between the high risk group and the low risk group of patients with GI hemorrhage admitted to the ED.

**Conclusion:** The Blatchford scoring system is accurate for identifying definitively low-risk patients of GI hemorrhage, even prior to the performance of emergency UGI endoscopy at the ED.

## Introduction

Upper gastrointestinal (UGI) bleeding is a common and important problem encountered by clinicians in emergency departments (ED). Emergency endoscopy for the management of UGI bleeding has gained widespread acceptance, because it is often useful in patients with persistent or recurrent bleeding, to treat active bleeding, prevent recurrence, and reduce the mortality associated with this condition.[1] The optimal timing for an emergency UGI endoscopy has been defined by the American Society of Gastrointestinal Endoscopy survey as being within the first 12 h after admission.[2]

It has been recently suggested that emergency UGI endoscopy should be performed in the ED.[3,4,5] However, compliance with this recommendation is not always feasible, because the ability to perform emergency endoscopy in all patients with UGI bleeding depends on the availability of trained staff on a 24-h basis.[6]

Recently, Kodali *et al.* demonstrated that 21% of all patients with bleeding peptic ulcer had a clean ulcer base at endoscopy and that these patients had only a 3% risk of recurrent bleeding. They concluded that this group of patients could be safely managed on an outpatient basis, contrary to the routine practice of admission and observation for 2–3 days. Because gastrointestinal endoscopy by itself occasionally induces GI bleeding and rebleeding,[7] emergency endoscopy is not a procedure without risk. Thus, the uniform recommendation of emergency endoscopy for all patients presenting with signs of UGI bleeding is questionable. In view of this fact, it is considered that establishment of criteria for patients with UGI bleeding who do or do not need early, urgent UGI endoscopy would be of great practical value.

Several scoring systems have been devised to diagnose patients at high risk of adverse outcomes and to differentiate them from those at a lower risk. One of these is the Blatchford scoring system, which is designed to calculate the risk score based on clinical variables to assess if patients with acute UGI bleeding need treatments such as blood transfusion, operative or endoscopic interventions to control their hemorrhage.

In Japan, emergency endoscopy is always conducted on patients who present with signs of UGI bleeding, such as hematemesis or melena.[8] No papers have been published from Japan on the accuracy of any scoring systems to identify patients with GI bleeding at high risk of adverse outcomes. Thus, the decision to perform

 

**Table 1** Blatchford score (range of scores 0–23)[†]

| Admission risk marker | Score component value | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 6 |
| Blood urea (mmol/L) | <6.5 | | ≥6.5–<8.0 | ≥8.0–<10.0 | ≥10.0–<25.0 | ≤25.0 |
| Hemoglobin (g/L) for males | ≤130 | ≥120–<130 | | ≥100–<120 | | <100 |
| Hemoglobin (g/L) for females | ≤120 | ≥100–<120 | | | | <100 |
| Systolic blood pressure (mmHg) | ≤109 | ≥100–<109 | ≥90–≤99 | <90 | | |
| Pulse (per min) | <100 | ≥100 | | | | |
| Presentation with melena | No | Yes | | | | |
| Presentation with syncope | No | | Yes | | | |
| Complicated by hepatic disease | No | | Yes | | | |
| Complicated by cardiac failure | No | | Yes | | | |

[†]Cited in Blatchford *et al.*[9]

emergency endoscopy is currently not based on the use of any objective scoring system.

In this study, we assessed the accuracy of the Blatchford scoring system for screening patients with UGI bleeding and identifying those not in need of clinical interventions, including emergency endoscopy. We retrospectively applied the Blatchford scoring system to patients who presented with signs of UGI bleeding and underwent emergency endoscopy in the ED of our hospital.

## Methods

This retrospective observational study was conducted using the existing medical records of patients admitted to the ED of Keio University Hospital between January 2004 and December 2005. The study was conducted with the approval of the Ethics Committee of the ED at the Keio University Hospital. A comparison was conducted with the gastrointestinal endoscopy records at the Center for Diagnostic and Therapeutic Endoscopy to ensure that all the patients were identified. The authors extracted these data and cross-checked for any errors.

In the present study, endoscopy conducted within 3 h of admission to the ED was defined as emergency endoscopy. Patients suspected to have UGI bleeding based on their presentation with hematemesis, tarry stool, or syncope with anemia who underwent emergency endoscopy at our ED were enrolled in this study. Patients who were treated at other hospitals before transfer to our hospital were excluded from the analysis.

We calculated the Blatchford scores of the patients based on their vital signs, complete blood cell counts, blood chemistry tests, and past and present histories of illness (Table 1) extracted from the medical records of the patients. The first values of the respective parameters on presentation at the ED were calculated. Those who needed a blood transfusion, operative or endoscopic interventions to control the hemorrhage were classified into the high risk group. Conversely, those who did not require any of the above interventions were classified into the low risk group. Patients in the low risk group were deemed not to need emergency endoscopy.

All the data were expressed as mean ± SD. The Blatchford scores were analyzed using simple *t*-tests. *P*-values <0.05 were considered to be statistically significant. Statistical analyses, including calculation of the median values and ranges, were performed using StatMate III statistical software (ATMS, Tokyo, Japan).

**Table 2** Distribution of endoscopic diagnosis in the low risk and high risk groups

| Diagnosis | Low risk group | High risk group |
|---|---|---|
| Gastric ulcer | 7 | 40 |
| Duodenal ulcer | 4 | 10 |
| Esophageal or gastric varices | 0 | 5 |
| Acute gastric mucosal lesion | 1 | 1 |
| Gastric cancer | 1 | 7 |
| Esophageal cancer | 0 | 1 |
| Mallory Weiss syndrome | 2 | 1 |
| Erosive gastritis | 3 | 0 |
| Unknown and other | 5 | 5 |
| Total | 23 | 70 |

## Results

In total, the medical records of 7264 patients visiting the ED between January 2004 and December 2005 were collected. Although 96 patients (1.3%) satisfied the inclusion criteria for this study, three patients were excluded because they had received treatment at other hospitals prior to their transfer to our hospital. Finally, 93 patients (mean ± SD age 61.4 ± 16.2 years; range 19–94 years; male : female ratio 72:21) were enrolled in this study. Among the 93 patients, 70 patients (75.3%) required blood transfusion, operative or endoscopic interventions for the control of hemorrhage. The most common endoscopic diagnosis was gastric ulcer in both the high risk and the low risk group (Table 2). The Blatchford score was significantly higher in the high risk group than in the low risk group (Fig. 1). From the receiver operating characteristic curve of the Blatchford scoring system (Fig. 2) and distribution of the Blatchford scores in the high risk and low risk groups (Fig. 3), a Blatchford score of 2 was determined to be a suitable cut-off value to distinguish the high risk group from the low risk group. When this cut-off value was used, 100% of cases with more serious bleeding needing blood transfusion, operative or endoscopic interventions (i.e. the high risk group) were identified based on the Blatchford scores (100% sensitivity); 13% of cases with minor or no bleeding UGI lesions were also identified as not

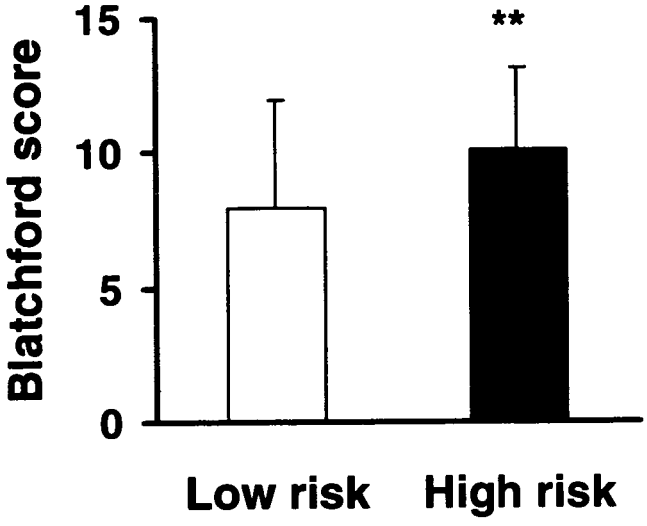


**Figure 1** Mean Blatchford score in the high risk group and the low risk group. The 95% confidence intervals for the difference was 0.56–3.75. $^{**}P < 0.01$ compared with that in the low risk group.

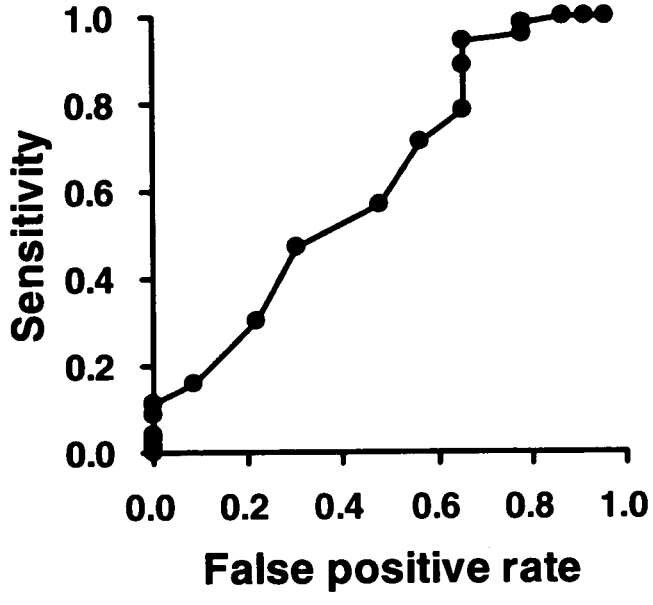


**Figure 2** Receiver operating characteristic curve of the Blatchford scoring system. *X*-axis and *y*-axis refer to the false positive rate and sensitivity, respectively. Area under the curve is 0.628.

needing any of the above interventions (13% specificity). These values were almost the same as those first reported by Blatchford *et al.*[9] Using this cut-off value, the highest sensitivity, lowest negative likelihood ratio and maximum negative predictive-value (NPV) (1.000) were also calculated (Table 3). In the low risk group, three patients had a Blatchford score under 2, including one each with Mallory Weiss syndrome, acute gastric mucosal lesions, and normal UGI endoscopic findings.

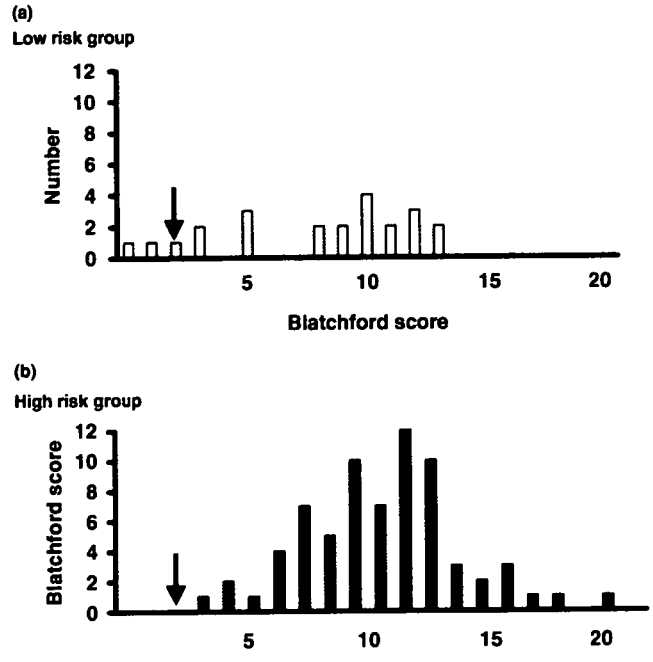


**Figure 3** Distribution of Blatchford scores in the (a) low risk group and (b) high risk group. Arrow indicates a Blatchford score of 2, which was considered to be a suitable cut-off value.

## Discussion

According to the original report[9] by Blatchford *et al.* a score of 0 was considered to represent a 'low risk' score in terms of adverse clinical outcomes in cases of UGI bleeding. Using this cut-off value, they reported a sensitivity and specificity of the scoring system of 96% and 32%, respectively. In our study, when the score of 0 was used as the cut-off value, we calculated a sensitivity and specificity of 100% and 3.4%, respectively. Thus a lower specificity than that using our present cut-off value of 2 was obtained.

In the present study, the Blatchford score were calculated based on the data in the medical records of the patients. In spite of its retrospective nature, one of the merits of our study was that all patients with symptoms and signs of GI bleeding seen at the ED during the study period were admitted to the hospital for further evaluation and treatment. Thus, we had a complete data set for the period spanning January 2004 to December 2005.

At our ED, so as to not miss serious GI bleeding or other serious disease in any of the cases, even patients presenting with fatigue or syncope who are not initially suspected to have UGI bleeding were examined carefully by detailed and precise history-taking, physical examination and laboratory testing. Thus, in the present study, patients who were not initially suspected to have UGI bleeding were also included. Some of these patients were then detected to have anemia or tarry stool based on a detailed and precise history-taking, physical examination and laboratory testing. Then, all patients who were suspected to have UGI bleeding were examined by UGI endoscopy so as to not miss patients with UGI bleeding. In the diagnosis and treatment of acute UGI bleeding, a missed hemorrhagic lesion might result in a fatal delay of appropriate care.


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**Table 3** Sensitivity, specificity, negative likelihood ratio and negative predictive value when the cut-off value is set at 0–3

| Cut-off value | Sensitivity (%) | Specificity (%) | Negative likelihood ratio | Negative predictive value |
|---|---|---|---|---|
| 0 | 100.0 | 4.3 | 0.000 | 1.000 |
| 1 | 100.0 | 8.7 | 0.000 | 1.000 |
| 2 | 100.0 | 13.0 | 0.000 | 1.000 |
| 3 | 98.6 | 21.7 | 0.066 | 0.833 |

Thus, a test with high sensitivity is required. Because missing a patient at high risk might result in a fatal outcome, we weighted highest sensitivity rather than specificity when setting the cut-off value for the Blatchford score. When a Blatchford score of 2 was used as the cut-off value, 87% of patients in the low risk group underwent emergency endoscopy. This might be considered to represent over-diagnosis. To avoid missing incipient or critical hemorrhagic lesions, such over-diagnosis might be inevitable in the clinical setting as extreme vigilance is warranted.

The Japanese Emergency Medical System has a three-tiered emergency transfer system composed of primary care clinics, secondary and tertiary critical care emergency centers.[10] In Japan, ambulance services select which type of centers patients should be transferred to. European or American style emergency medical systems which receive all types of patients are uncommon in Japan.[11,12] Although the ED at our hospital is classified as a tertiary critical care emergency center, our ED does receive all types of patients, much like the European or American style emergency medical systems. Such an emergency medical care system, while valuable, is unusual in Japan. Lee *et al.* reported that early endoscopy performed shortly after admission to the ED allowed safe triage of 46% of patients with non-variceal UGI bleeding to outpatient care, allowing for a significant reduction in hospital stay and costs.[4] If we can distinguish between the patients in the low risk group and those in the high risk group using the Blatchford score at the earliest point of entry into the hospital, it might be possible to further reduce the length of hospital stay and associated costs.

Recently, Adamopoulos *et al.* reported on a new scoring system based on the findings of nasogastric tube aspiration, hemodynamic instability, and the hemoglobin level and white blood cell count.[13] Although this scoring system had a high sensitivity and specificity, insertion of a nasogastric tube may be considered as an invasive intervention.

Patients with UGI bleeding who present with only syncope or fatigue without hematemesis or melena may be transferred to secondary emergency care hospitals not equipped to conduct emergency endoscopy. Use of the Blatchford scoring system might be useful in such cases to judge the timing of transfer of patients to such hospitals.

Among the 70 cases in the high risk group in the present study, there were five who presented with gastroesophageal variceal bleeding. Conversely, according to the report of Nomura *et al.* on the other among 441 patients with UGI bleeding diagnosed by emergency endoscopy in their series, there were 115 cases with gastroesophageal variceal bleeding.[14] Thus, the number of cases with gastroesophageal variceal bleeding in our series was significantly lower than that in their series. At our hospital, patients with liver cirrhosis are examined by UGI endoscopy every 6 months to evaluate the status of their gastroesophageal varices. When a red color sign known to be suggestive of the risk of gastroesphageal bleeding is detected, patients are treated by a combination of endoscopic variceal ligation and endoscopic injection sclerotherapy which has been reported to have a high success rate.[15] This policy at our hospital might be one of the reasons for the relatively lower percentage of cases with gastroesophageal variceal bleeding in our series.

In conclusion, the Blatchford scoring system could be applicable for detecting definitely low-risk patients with UGI bleeding even prior to emergency UGI endoscopy in the clinical setting in Japan. Further randomized controlled studies should be performed to confirm the validity of the presently introduced scoring system.

## Acknowledgments

Author contributions: Tatsuhiro Masaoka Hidekazu Suzuki conceived of the idea and design of the study. Shingo Hori, Naoki Aikawa and Toshifumi Hibi supervised the performance of the study and the data collection. Tatsuhiro Masaoka collected and managed the patients' data, including statistical analysis of the data, and drafted the manuscript. All authors contributed substantially to its revision. Hidekazu Suzuki takes overall responsibility for the paper. This study was supported by a Grant-in-Aid for Scientific Research C (to Tatsuhiro Masaoka no. 15790360) from the Japan Society for the Promotion of Science (JSPS) and by a Keio Gijyuku Academic Development Fund.

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# Application of the Recent American Practice Resources for Risk Stratification System for Patients Presenting to a Japanese Emergency Department Because of Syncope

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SUMMARY

**Background:** The American College of Physicians (ACP) and the American College of Emergency Physicians (ACEP) recently published practice guidelines and recommendations for evaluation of patients with syncope based on historical, physical, and ECG findings. The objective of the present study was to determine if risk stratification using these practice resources is valid in a series of Japanese patients.

**Methods and Results:** A total of 912 consecutive patients brought to our emergency department between 1988 and 1997 because of syncope were identified. Follow-up information about mortality was obtained for 707 patients by means of mailed questionnaires and from medical records, and the mortality data were analyzed by the actuarial life-table method. A total of 187 patients who fulfilled the admission criteria according to the ACP guidelines were found to have higher overall and cardiac mortality than the other 520 patients ($P < 0.0001$), and 153 patients who fulfilled the admission criteria according to the ACEP recommendations also had higher overall and cardiac mortality than the other 554 patients ($P < 0.0001$).

**Conclusions:** The recent American practice recommendations can be used for risk stratification of syncope patients in Japan. Historical, physical, and ECG findings available on presentation can be used to stratify the risk of mortality in patients brought to Japanese emergency departments because of syncope. (Int Heart J 2007; 48: 513-522)

**Key words:** Syncope, Risk stratification, Guidelines, Mortality, Emergency care

SYNCOPE is a common medical problem that accounts for 3% of emergency department visits in the United States and Japan,[1,2] and it is a serious cause of injury and a prelude to lethal cardiac events.[1-16] However, the population of patients with syncope is heterogeneous, and the prognosis varies significantly, depending on the cause of the syncope and the associated comorbidities. Thus, evaluation and risk stratification of syncope patients is frequently a challenge in the emergency department.[10-12,17-19]

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The American College of Physicians (ACP) and the American College of Emergency Physicians (ACEP) recently reviewed the management of syncope patients and published practice resources to evaluate patients presenting at emergency departments with syncope.[7,8,17] The practice resources include an outline in regard to which patients should be admitted to the hospital based on the risk of an adverse outcome. Although they were established on the basis of evidence in previous published studies, the evidence has only been studied in the United States and Europe. Ethnic and geographic differences affect mortality from and the prevalence of cardiovascular disease, and they are lower in Japan than in Western countries.[2,20-25] The recommendations have not been validated in clinical practice in regard to syncope patients in Japan.

The objective of this study was to assess the effect of the recent American guidelines and recommendations on syncope evaluation in Japan by accurately identifying high-risk patients. Results of this study should provide useful information for recommendations designed to improve patient care in Japanese emergency departments.

## METHODS

A previously reported cohort[2] served as the subjects of this retrospective observational study. The study was conducted under the ethical guidelines for epidemiological studies (Ministry of Health, Labour and Welfare of Japan, 2002) based on the principles outlined in the World Medical Association's Declaration of Helsinki.

Syncope was defined as sudden, transient loss of consciousness associated with inability to maintain postural tone that was incompatible with a seizure, ver-

**Table I.** Indications and/or Recommendations for Hospital Admission in the ACP Guidelines and the ACEP Clinical Policy

| | Characteristics | ACP guidelines | ACEP clinical policy |
|---|---|---|---|
| History and/or physical signs | Coronary artery disease | Indicated | - |
| | Congestive heart failure | Indicated | Recommended |
| | Stroke | Indicated | - |
| | Significant valve disease | Indicated | Recommended |
| | Ventricular arrhythmia | - | Recommended |
| Symptom | Chest pain | Indicated | Recommended |
| ECG | Abnormal ECG | Indicated | Recommended |

Patients with syncope and any of the above factors should be considered to be at high risk of adverse outcome. ACP indicates American College of Physicians; ACEP, American College of Emergency Physicians; and ECG, 12-lead electrocardiogram.

tigo, dizziness, coma, shock, or other altered states of consciousness.[2,3,5-8,26] Patients who required pharmacological or electrical cardioversion at the time of initial visit were not included.

A total of 912 patients brought by ambulance to the emergency department of Keio University Hospital in Tokyo between August 1988 and December 1997 with symptoms compatible with syncope were retrospectively identified. Of these 912 patients, 205 were excluded because of incomplete follow-up data. The remaining 707 patients were eligible for this study. Of the 205 patients excluded from this analysis, 34 had incomplete diagnostic data in their charts, 34 had missing patient records, and 137 had no follow-up data. The reason that follow-up was not obtained was inability to contact by mail or lack of a repeat visit to Keio University Hospital.

ECGs obtained in the emergency department were classified into two groups, normal and abnormal, in the same manner as in the previous studies.[10-12,17-19] The findings in the abnormal group included rhythm abnormalities, conduction disorders, a short PR interval less than 100 ms, acute and/or old myocardial infarction, QT interval prolonged to over 460 ms, and atrioventricular block.

Follow-up information regarding mortality was obtained from mailed questionnaires filled out by the patients themselves or by their families, and/or from their medical records. The questionnaires were sent to 849 patients. Of those, 485 patients (57.1%) responded to the questionnaire survey, 213 patients left the questionnaire unanswered, and the remaining 151 patients did not receive the mailed questionnaire because of a change of address. The cause of death was assigned on the basis of information obtained from the family and/or the patient's records if available.

The ACP guidelines[7,8] include recommendations for hospital admission according to the apparent risk of adverse outcome (Table I). The cohort was divided according to the ACP guidelines into a group with indications for admission (ACP high-risk group) and a group without such indications (ACP low-risk group).

ACEP clinical policy[17] specifies recommendations for admission of patients with syncope, and the cohort was also divided according to the level B recommendation regarding criteria for admission of patients with syncope (Table I) into a group with indications for admission (ACEP high-risk group) and a group with no indications for admission (ACEP low-risk group).

Statistical analyses were performed using SPSS™ 12.0J software. Mortality data were analyzed using actuarial life-table methods. The Wilcoxon statistic was used to determine the statistical significance of differences between the groups.

**Table II.** Patient Characteristics and Outcomes

| Characteristic | Number of patients (%) | Number of deaths (%) | Univariate analysis | |
|---|---|---|---|---|
| | | | Odds ratio (95%CI) | *P* |
| Total | 707 (100) | 61 (100) | | |
| Age ≥ 40 years | 473 (66.9) | 60 (98.4) | 33.9 (4.7 to 245.8) | < 0.001 |
| Female | 320 (45.3) | 20 (32.8) | 0.6 (0.3 to 0.99) | 0.04 |
| History and/or physical signs | | | | |
| Coronary artery disease | 65 (9.2) | 8 (13.1) | 1.6 (0.71 to 3.4) | 0.25 |
| Congestive heart failure | 9 (1.3) | 5 (8.2) | 14.3 (3.7 to 54.9) | < 0.001 |
| Stroke | 31 (4.4) | 5 (8.2) | 2.1 (0.79 to 5.7) | 0.18 |
| Significant valve disease | 3 (0.4) | 1 (1.6) | 5.4 (0.5 to 60.1) | 0.24 |
| Ventricular arrhythmia | 2 (0.3) | 0 (0) | - | 1.00 |
| Symptom | | | | |
| Chest pain | 40 (5.7) | 9 (14.8) | 3.4 (1.6 to 7.6) | 0.005 |
| ECG | | | | |
| Abnormal* | 130 (18.4) | 22 (36.1) | 2.8 (1.6 to 4.9) | 0.001 |
| ACP guidelines | | | | |
| Indication for admission | 187 (26.4) | 30 (49.2) | 3.0 (1.8 to 5.1) | < 0.001 |
| ACEP clinical policy | | | | |
| Recommendation for admission | 153 (21.6) | 26 (42.6) | 3.0 (1.8 to 5.2) | < 0.001 |

ACP indicates American College of Physicians; ACEP, American College of Emergency Physicians; and ECG, 12-lead electrocardiogram.
Abnormal ECG*: 29 patients with atrial fibrillation, 46 patients with conduction disorders, 1 patient with WPW syndrome, 24 patients with old myocardial infarction, 7 patients with acute myocardial infarction, 27 patients with prolonged QT, 6 patients with complete atrioventricular block, and 2 patients with second degree atrioventricular block.

## RESULTS

The characteristics of the 707 patients are shown in Table II. There was a bimodal age distribution, with peaks at 20-29 years and 60-79 years. Patients older than 39 years accounted for two-thirds of the total (Figure 1). The median follow-up period was 38 months, and 63 patients died during the follow-up period (Table III).

Of the 707 patients, 187 (26.4%) were classified into the ACP high-risk group and the other 520 patients (73.6%) into the ACP low-risk group. The actuarial life-table analysis revealed 16.4% overall mortality and 6.7% cardiac mortality in the ACP high-risk group at 5 years, and the mortality was significantly higher than the 6.8% overall mortality and the 0% cardiac mortality in the ACP low-risk group ($P < 0.0001$, Figures 2 and 3).

Of the 707 patients, 153 (21.6%) were classified into the ACEP high-risk group, and the other 554 (78.4%) into the ACEP low-risk group. The actuarial life-table analysis revealed 16.2% overall mortality and 6.6% cardiac mortality in

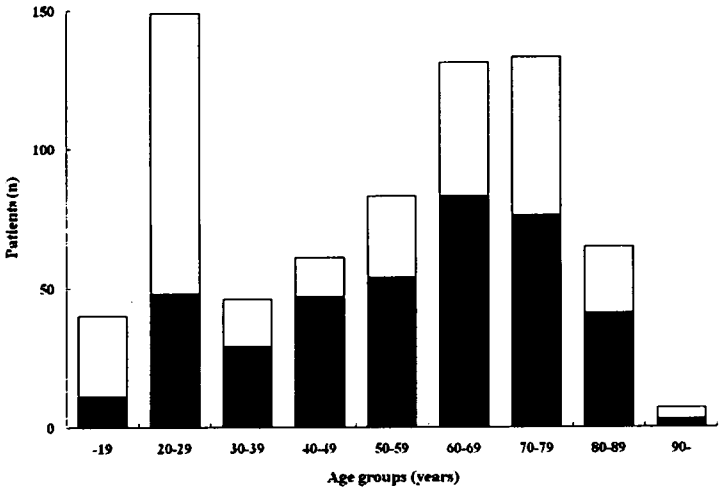


**Figure 1.** Age distribution of all 709 patients.
Closed bars represent male patients, and open bars female patients. There was a bimodal age distribution, with peaks at 20-29 years and 60-79 years.

**Table III.** Causes of Death

| Cause of death | Number of patients (%) |
|---|---|
| Total | 61 (100) |
| Cardiac death | 18 (29.5) |
| Sudden death | 6 (9.8) |
| Heart failure | 8 (13.1) |
| Acute myocardial infarction | 3 (4.9) |
| Pulmonary embolism | 1 (1.6) |
| Noncardiac death | 37 (60.7) |
| Cancer | 15 (24.6) |
| Pneumonia | 4 (6.6) |
| Trauma | 7 (11.5) |
| Stroke | 3 (4.9) |
| Renal failure | 3 (4.9) |
| Miscellaneous | 5 (8.2) |
| Unidentified | 6 (9.8) |

the ACEP high-risk group at 5 years, and the mortality was significantly higher than the 6.5% overall mortality and the 0.7% cardiac mortality in the ACEP low-risk group ($P < 0.0001$, Figures 4 and 5).

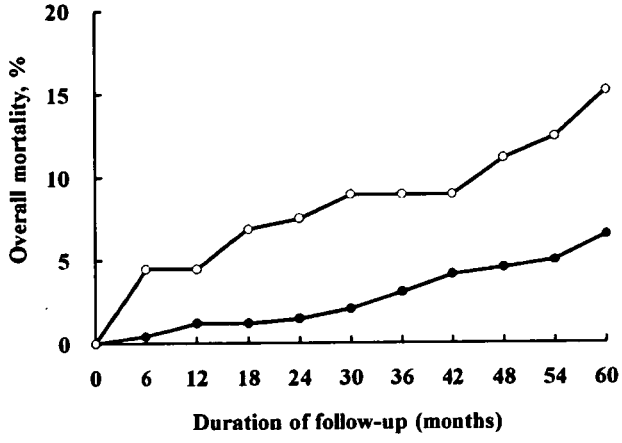


**Figure 2.** Comparison between overall mortality in the ACP high-risk group and low-risk group.
Closed circles indicate cumulative mortality in the ACP high-risk group and open circles cumulative mortality in the ACP low-risk group. Overall mortality analyzed by the actuarial life-table method shows higher mortality in the ACP-high risk group ($P < 0.0001$).

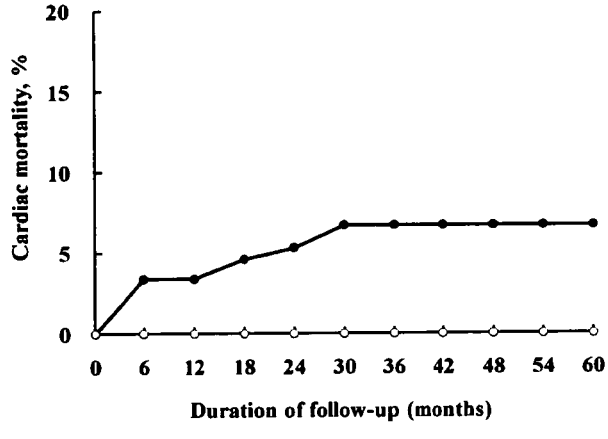


**Figure 3.** Comparison between cardiac mortality in the ACP high-risk group and low-risk group.
Closed circles indicate cumulative mortality in the ACP high-risk group and open circles cumulative mortality in the ACP low-risk group. Cardiac mortality analyzed by the actuarial life-table method shows higher mortality in the ACP-high risk group ($P < 0.0001$).

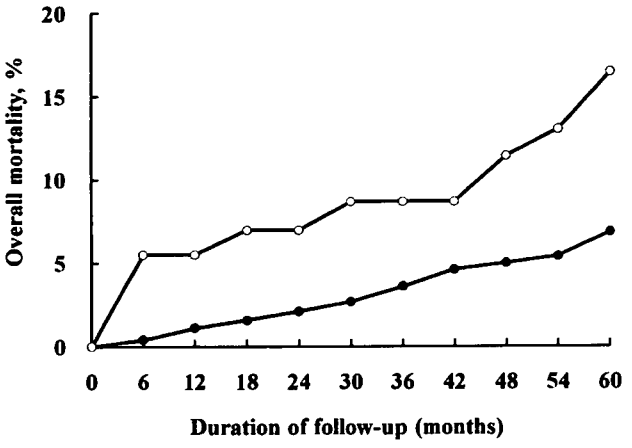


**Figure 4.** Comparison between overall mortality in the ACEP high-risk group and low-risk group.
Closed circles indicate cumulative mortality in the ACEP high-risk group and open circles cumulative mortality in the ACEP low-risk group. Overall mortality analyzed by the actuarial life table method shows higher mortality in the ACEP high-risk group ($P < 0.0001$).

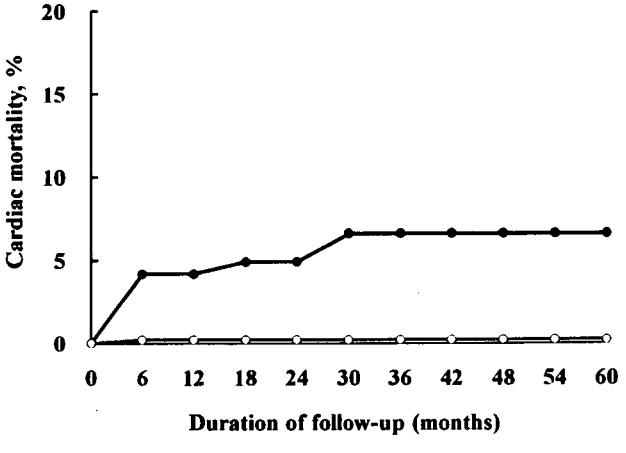


**Figure 5.** Comparison between cardiac mortality in the ACEP high-risk group and low-risk group.
Closed circles indicate cumulative mortality in the ACEP high-risk group and open circles cumulative mortality in the ACEP low-risk group. Cardiac mortality analyzed by the actuarial life table method shows higher mortality in the ACEP high-risk group ($P < 0.0001$).

## DISCUSSION

In this study we applied risk stratification based on the recently published American guidelines and recommendations associated with overall and cardiac mortality to a Japanese cohort of patients with syncope. These clinical resources are based on noninvasive clinical data and allowed us to identify high-risk patients with syncope.

Syncope is often difficult to evaluate in the emergency department. Patients are usually symptom-free when seen after an episode, and the results of the clinical assessment and initial ECG may be unremarkable. If the cause of the syncope can be ascertained on the basis of the initial clinical assessment, management decisions are straightforward. However, in more than one-third of the patients the cause is not apparent from the initial history, physical examination, and ECG,[2,3,6,13,17,26,27] and when that happens the focus of evaluation is directed to finding serious events that may not be apparent from the initial clinical assessment. The guidelines of the ACP and the ACEP for assessment, risk stratification, and admission of patients were drawn up after an extensive literature review and have recently been published.[7,8,17] They identified the clinical characteristics associated with mortality risk and indications for hospital admission in patients with syncope.

Ethnic and geographic differences between Japan and Western countries may affect mortality from and the outcome of cardiovascular diseases.[2,20-25] Since cardiovascular disease mortality has been reported to be lower in the Japanese population than in Western populations, and the outcome of Japanese patients with cardiovascular diseases is better than that of Western patients,[20-25] the risk of mortality in Japanese patients with syncope may be different than in Western countries. However, no studies on risk stratification of patients with syncope for overall mortality in Japan have been published. The findings in this study showed for the first time that the recent American practice recommendations can be used for risk stratification of syncope patients in the Japanese population. This reinforces the importance of attempting to identify a potential cardiac source of syncope in emergency settings and predicts higher mortality in a country with a different lifestyle and incidence of cardiovascular disease.

As shown in Figure 2, there was a bimodal age distribution, with peaks at 20-29 years and 60-79 years. It was a similar pattern to that observed in the Western general population and general practice.[9,28-30] The bimodal age pattern of the incidence of syncope observed in the general population could be mirrored in general practice.[28] Therefore, this finding may suggest that its age distribution in the Japanese population is in accordance with that of Western populations.

There are several limitations in this study. First, since the cohort consisted of

retrospectively identified patients with syncope who were brought by ambulance to the emergency department of a university hospital in Tokyo, and follow-up information was collected from less than 80% of the patients initially identified as having had syncope, the cohort was highly selective. Second, only 18 cardiac deaths were observed in this cohort, and the number was too small to evaluate the risk of cardiac mortality. However, the findings provide valuable information related to improving emergency care in Japan.

In conclusion, the recent American clinical guidelines and recommendations on syncope evaluation enabled identification of high-risk patients in a Japanese population. Historical, physical, and ECG findings available at the time of presentation can be used to stratify risk of mortality in patients brought to Japanese emergency departments because of syncope.

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# ORIGINAL ARTICLE

# The Incidence of Sickness/trauma in Spectators of Professional Baseball at the Meiji Jingu Baseball Stadium

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**Abstract. The Meiji Jingu Baseball Stadium attracts a large number of spectators in the Tokyo metropolitan area. To clarify the demand for medical care at a public ballpark, we analyzed following two types of medical records maintained at the stadium: (1) "Report of Aid": a record of patients visiting the first-aid station in 2003 season and (2) "Report of Accidents": a record of patients referred to clinics/hospitals between 1996 and 2003 season. (1) In 2003, approximately 1,582,000 spectators watched 67 professional baseball games (60 night games). Of the 247 spectators received medical care at the first-aid station (3.7 persons per game, 1/6,405 spectators), 128 (51.8%) had trauma and 109 (44.1%) had illness. The incidence of trauma was relatively higher before the start and near the end of the night games. The risk of becoming sick/wounded per spectator or the number of the sick/wounded per game differed depending on the participating sports teams. (2) Ninety-three spectators referred to clinics/hospitals during the 8-year period from 1996 to 2003, of which 57 were transferred by ambulance. Direct ball injury accounted for 65 (69.9%) cases of trauma, followed by stumbling/falls (18 cases, 19.4%). Twenty patients were diagnosed to have fractures at the clinics/hospitals. Intrinsic cardiopulmonary arrest occurred in one spectator. Trauma due to direct ball injury accounted for the largest number of wounded patients referred to clinics/hospitals. Treatment to patients at the first-aid station in the stadium may optimize the frequency of hospital visits. Records of medical care are effective to analyze the demand for medical preparedness.** (Keio J Med 56 (3) : 85 – 91, September 2007)

**Key words: mass gathering medicine, large-scale public facility, baseball stadium, medical facility, event planning**

## Introduction

Various types and levels of medical aid may be provided at large-scale public facilities that are visited by large and diverse crowds.[1] Therefore, some facilities have a first-aid station and encourage the staff to undergo training in cardiopulmonary resuscitation. However, standards for organization of the first-aid station and equipment / materials at public facilities have not yet been established to date, and are vaguely based on the subjective experience of administrators of facilities.[2] To resolve this problem, we considered that it would be necessary to analyze the demand for medical care in individual public facilities by precisely comprehending the occurrence of sickness and injury at the concerned facility.

Large-scale athletic games are held at many cities around the world. Even though the players in the participating teams come in a perfect state of medical preparedness,[3] adequate medical care for spectators still remains to be established. Recently, there has been an increasing awareness of the occurrence of medical emergencies at sports events in Japan, especially from the time that the

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**Table 1 Sick/wounded persons visiting a first-aid station in 2003**

| | | Number (percentage) | Trauma | Sickness | Others |
|---|---|---|---|---|---|
| Male | | 118 (53.4) | 55 | 56 | 7 |
| Female | | 103 (46.6) | 60 | 42 | 1 |
| Total | | 221 (100) | 115 | 98 | 8 |
| Disposition | Discharged to home | 197 (89.1) | 101 | 88 | 8 |
| | Self-visit to clinics/hospitals | 14 (6.3) | 9 | 5 | 0 |
| | Transfer by ambulance | 10 (4.5) | 5 | 5 | 0 |

Unit: Number of patients
Number of sick / wounded persons visited first-aid station was analyzed from "Report of Aid" in 2003. After receiving the first-aid, 24 (10.8%) of the spectators visited clinics / hospitals on the day of the game, and 10 (4.5%) of them were transferred as emergency patients.

**Table 2 Symptoms/diagnosis of sickness at first-aid station in 2003**

| Symptom, Diagnosis | Cases |
|---|---|
| Gastrointestinal symptoms (Nausea, Abdominal pain, etc.) | 29 |
| Hypoglycemic seizures | 11 |
| Headache | 11 |
| Discomfort | 10 |
| Hypotension | 9 |
| Dehydration/heat related illness | 7 |
| Common cold | 6 |
| Pyrexia | 5 |
| Dizziness | 5 |
| Hyperventilation | 4 |
| Loss of consciousness | 3 |
| Menstrual pain | 2 |
| Others | 8 |
| Total | 110 |

Unit: Number of patients (98 patients)
Symptoms / diagnosis of sickness was analyzed from "Report of Aid" in 2003. Diverse medical conditions were encountered.

Soccer World Cup was held in Japan in 2002.[4,5]

Among the many athletic facilities located in the metropolitan area of Tokyo, the Meiji Jingu Baseball Stadium attracts large crowds (at least 2,000,000 annually, including 1,582,000 who watched professional baseball games in 2003), because a professional baseball club as a franchise often utilizes the stadium to host baseball matches. Further, the stadium is equipped with a first-aid station which maintains records of medical care provided to visiting spectators with sickness/trauma. The aim of this study was to analyze the demand for medical care during professional baseball matches held at the stadium, based on analysis of the records.

## Subjects and Methods

The Meiji Jingu Baseball Stadium built in 1926 is one of the most famous ballparks in Japan. There is a first-aid station at the stadium and records of the recent first-aid practices at the stadium have been maintained in two types of documents: "Report of Aid" written by nurses and "Report of Accidents" written by clerks. The former contains reports of information on patients visiting the first-aid station, including the gender, age, time of visit, type of disease, and site of injury. The latter contains reports of patients referred to clinics/hospitals.

An investigation of the sick/wounded persons who required medical care during the professional baseball games (March to November) was performed by examining both the records. The number and incidence of sickness and injury, the time of occurrence, the types of sickness and injury, and the sites and mechanisms of injury, disposition after the first-aid, and diagnosis of the patients who were transferred to clinics/hospitals were noted. As for the diagnosis of the patients referred to clinics/hospitals, it was reported to the stadium either by the patients themselves or by the clerks who visited the clinics/hospitals with the transferred patients.

The study period spanned the professional baseball season of 2003 (from March to November) for examination of the "Report of Aid", and 1996 to 2003 for that of the "Report of Accidents".

Statistical analyses were performed by the Chi-square test using the Mac Toukei-Kaiseki Ver. 1.5 (Esumi co. ltd., Tokyo, Japan) program on a Macintosh computer. A significance level of $P < 0.05$ was set for the comparisons.

## Results

### 1. Number of sick/wounded persons and disposition at the first-aid station

During the baseball season of 2003, there were 67 games (60 night games, 7 daylight games) hosted by professional baseball clubs, of which 61 were official games and 2 were called off due to rain. A total of 1,582,000 spectators watched the 59 official games (mean: 26,813 persons per game) during this season, and 247 spectators (mean: 3.7 persons per game, including all games), accounting for 0.015% of all spectators, received aid at the first-aid station of the stadium. After excluding 17 staff members of the stadium and 9 persons whose gender was

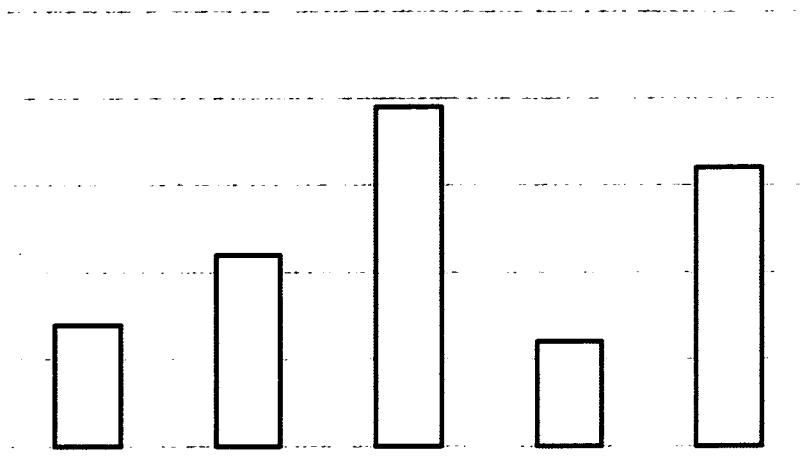

**Fig. 1 Sites of trauma at a first-aid station in 2003**
Sites of trauma were analyzed from "Report of Aid" in 2003. The incidence of upper and lower extremity injuries was high.

not recorded in the reports from this figure, there were 221 sick/wounded persons, consisting of 118 males (53.4%) and 103 females. In regard to the type of sickness/trauma, 46.6%, 47.5%, and 5.9% of the males were recorded as having suffered from trauma (including 2 cases of burns), sickness, and "others" (insect bite, toothache, etc.), respectively. The corresponding percentages among the women were 58.3% (including 4 cases of burns), 40.8%, and 0.9%, respectively. After provision of first-aid, 24 (10.8%) of the 221 patients were referred to clinics/hospitals, of which 10 (4.5%) were transported by ambulance (Table 1).

## 2. Types of sickness and trauma encountered at the first-aid station

Patients with acute sickness had diverse symptoms; *e.g.*, gastrointestinal symptoms, abdominal pain, headache, hypoglycemia, mood disorders, hypotension, dehydration/heat stroke, and common cold (Table 2). In 127 sites of the 115 patients with trauma, trauma of the upper and lower extremities accounted for the highest percentage of cases (Figure 1). In the referred patients to clinics/hospitals with trauma, facial and oral cavity trauma accounted for the highest percentage of cases from 1996 to 2003. During this 8-year study period, direct trauma caused by balls accounted for 118 (76.6%) of the wounded patients, followed by that due to stumbling/falls (27 patients, 17.5%) (Figure 2).

## 3. Diagnoses made at the clinics/hospitals

In the patients referred during the period from 1996 to 2003, 20 patients were diagnosed to have fractures. Among the 20, 10 who sustained the fracture by direct ball attack and 5 in whom it was caused by stumbling/falls were transferred to the clinics/hospitals by ambulance, and 5 (including 4 who sustained the fracture by direct ball attack and 1 in whom it was caused by stumbling/falls) visited the clinics/hospitals on their own. Seven and 2 subjects among those who were injured by a direct ball attack were diagnosed to have eye injuries and crown fractures of the teeth, respectively (Table 3).

## 4. Time of occurrence of the sickness/trauma in the spectators visiting the stadium for the night games

The time of occurrence of sickness and trauma was analyzed for the 230 spectators of the 60 night games in 2003 who required first-aid. The incidence of trauma was the highest before the start of a game and near the end of the games, and the incidence of acute illness was the highest before the start of a game and during the second half of the game (Figure 3).

## 5. Incidence of sickness and trauma according to the participating teams

In 2003, Yakult Swallows, *i.e.*, the franchise baseball team and a member of the Central League, played 59 official games with 5 teams. The incidence of sickness/trauma was the highest during the game played by the

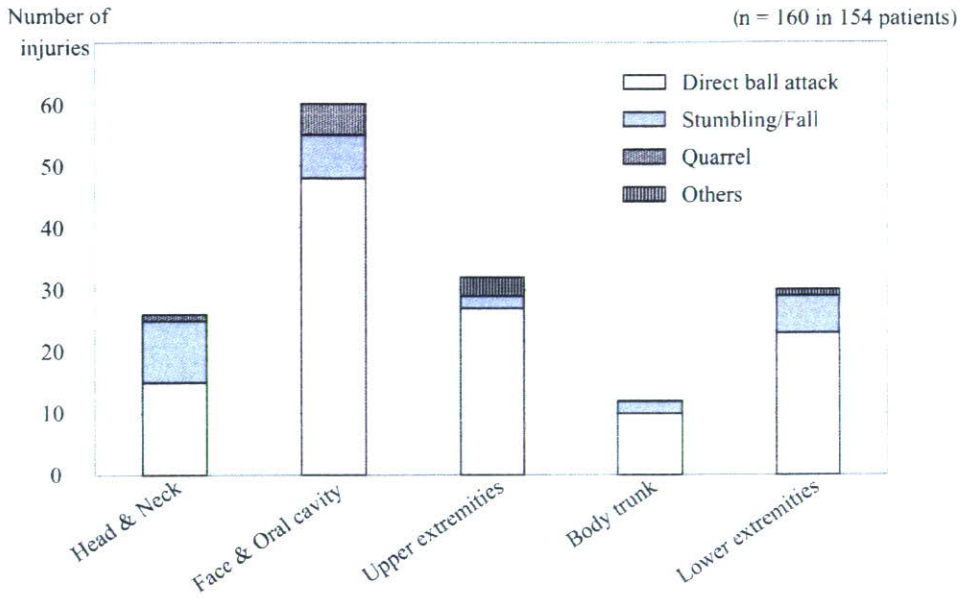


**Fig. 2 Sites and causes of trauma in patients referred to clinics/hospitals from 1996 to 2003**
Sites of trauma and causes of trauma were analyzed from "Report of Accidents" during the period 1996-2003. Most of trauma is by direct ball attacks. Trauma of the head and face are tended to be serious in many cases.

**Table 3 Classification of trauma in referred patients from 1996 to 2003**

| | Direct ball attacks | | Stumbling/falls | |
|---|---|---|---|---|
| | Ambulance | Self-visit | Ambulance | Self-visit |
| Blows | 12 | 18 | 4 | 0 |
| Fractures | 10 | 4 | 5 | 1 |
| Open wounds | 10 | 3 | 5 | 4 |
| Eye injuries | 6 | 1 | 0 | 0 |
| Crown fractures | 0 | 2 | 0 | 0 |
| Total | 38 | 28 | 14 | 5 |

Unit: Number of patients
Definitive diagnosis made at clinics / hospitals and transportation to the clinics / hospitals were analyzed from "Report of Accidents" during the period 1996-2003.

victorious team of that season (Hanshin Tigers in 2003). The risk (incidence of visits to first-aid station) per spectator was 2.13 times as high as compared to that for the team with the lowest incidence of sickness/trauma in that season ($P < 0.01$), and the risk per game was 4.47 times as high as compared to that for the team with the lowest incidence of sickness/trauma ($P < 0.01$) (Table 4).

## Discussion

While there have been several reports on the demand for the medical care at mass events, the majority have dealt with only a single event.[1,6] Continuous observation of the medical demand at the same events has been reported for the national football league games in the USA.[7] Although baseball games are also popular, there has been no study until now for medical care at any stadium hosting baseball matches. One study has reported on the degree of sweating and water intake in baseball spectators in the summer.[8] Another report reviewed first-aid at a stadium during a US Major League Baseball season in 1991, however, it contains no detailed data of the patients.[9]

The present study revealed that 3.7 sick/wounded persons per professional baseball game utilized the first-aid station at the stadium during the professional baseball season in 2003. This rate is not high, and represents only 0.015 % of all the spectators, *i.e.*, only 1 out of every 6,405 spectators, as compared with that reflected in the records of the previously mentioned national football league game season in the USA (0.04%),[7] 2002 FIFA World Cup soccer games in Japan (0.12 %),[10] and a rock festival in Japan (1.7 %).[11]

Sick/wounded persons who utilized the services of the first-aid station had diverse symptoms or trauma, and the most frequent cause of trauma in those who attended the first-aid station was direct ball attacks, followed by stumbling/falls, quarrels, and burns due to hot foods/beverages. In particular, the incidence of trauma caused by direct hits of balls was the highest, which is considered to be characteristic of ballparks.[12] The incidence of trauma due to stumbling/falls was also high. It was speculated that the occurrence of these accidents could be in-

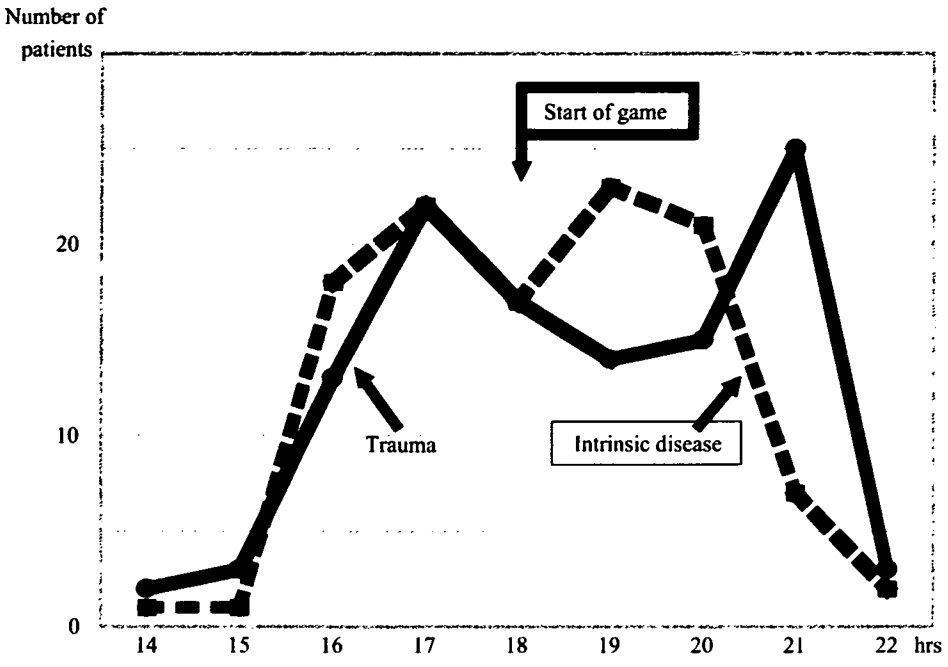


**Fig. 3 Time of occurrence of sickness / trauma in the night games**
The time zone of the occurrence of sickness / trauma in the night games was analyzed from "Report of Aid" in 2003. The number of night games was 60, 2 of them were called-off by rain.

fluenced by the inherent stadium structure (high slope and narrow pathways), overcrowding/stampede inside the stadium, and alcohol consumption.

At the Meiji Jingu ballpark, the first-aid station is on the ground floor next to the office. It is equipped with a bed, refrigerator, closet for drugs, TV, stretcher, wheelchair, and crutches, however, there is no arrangement yet for an automatic external defibrillator (AED) in 2003.[13] However, rescue drills for sick/wounded persons have been carried out over the years about 3 - 4 times a year with the cooperation of the nearest fire station. During the games hosted by professional ball teams, one physician and one or two nurses contracted by the stadium are kept on standby at the first-aid station. Guards on duty, recruited from a security company, who find sick/wounded patients, communicate with the station via a wireless system. Depending on the situation, either the physician or the nurse is dispatched to attend to the sick/wounded, or alternatively, the sick/wounded are transferred to the first-aid station for medical care. As a rule, the stadium takes responsibility for the care of cases of trauma caused by inadequacy of facilities, and the franchisee ball team takes responsibility for the care of cases of trauma caused by balls.

Grange JT *et al.* reported that the availability of on-site physician-level medical care at large mass gatherings significantly reduced the number of patients requiring transport to hospitals.[14] In fact, in the 2003 season, only 24 (10.8%) patients visited clinics/hospitals on the day of the game, and only 10 (4.5%) of these were transferred by ambulance after provision of first-aid. Thus, the availability of a physician on-site is important to reduce the impact on the local emergency medical system and the local medical facilities.

Analysis of the actual time of occurrence of the sickness/trauma revealed that the incidence of trauma was the highest before the start of a game and near the end of the game, while that of sickness was highest before the start of a game and during the second half of the game. Thus, before the start of a game, direct trauma caused by ball attacks during warm-up practice and sickness induced by excitement before the game may be contributing factors. During the second half of the game, alcohol consumption and excitement due to the match coming to an end probably induces sickness, and near the end of the game, trauma due to overcrowding and stampede may be involved. It should be borne in mind that sickness and trauma may be reported until all the spectators have left the stadium.

The incidence of sickness/trauma among the spectators may be influenced by the number of spectators, as shown by the varying incidence according to the participating teams. During the game played by Hanshin Tigers, which emerged as the victorious team in the 2003 season, an average of 7.6 spectators (a maximum of 18 spectators per game) suffered from sickness/trauma. The