

Analysis of Factors Related to Length of Stay Time in Patients with Back Pain at Emergency Department

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Purpose: Most patients with acute low back pain visit emergency room (ER). They mostly need beds, and if their length of stay is longer, it can become difficult to accommodate new patients at the ER. We analyzed the treatment process of patients with back pain and tried to find method for shortening of the length of stay at the ER.

Methods: We retrospectively analyzed the medical records of patients with back pain who visited at our ER for one year. Patients were divided into two groups according to their length of stay at ER and were compared the characteristics of between two groups.

Results: A total of 274 patients were included in the study. Eighty-nine patients (32.5%) were in the group with less than 3 hours and 185 patients (67.5%) were in the other group. In the comparison of the two groups according to the medical departments, the number of patients who were in group with more than 3 hours were 25 (14.0%) in the emergency department, 94 (50.5%) in neurosurgery, 66 (35.5%) in orthopedic surgery. Length of stay was significantly increased in orthopedic surgery and neurosurgery ($p=0.014$). In addition, the length of stay was longer when computed tomography and magnetic resonance imaging examinations were performed ($p=0.000$). Regardless of the type of analgesic agent, the median time to the analgesic treatment was shorter in the group with less than 3 hours ($p=0.034$).

Conclusions: In patients with back pain who visit the ER, the emergency medicine doctor will early control the pain and do not unnecessary image examination to reduce a length of stay at the ER.

Keywords: Back pain; Length of stay; Emergency departments

INTRODUCTION

Several studies have sought to find causes and solutions of the overcrowding for the right function of emergency room (ER), but they have not been able to provide clear methods and have reported that efforts at the national level are necessary for the issue to be solved [1]. As a solution to the overcrowding, there is also a report that the shortening of patients' stay time has been achieved through the analysis of the treatment process [2]. However, because there are many factors that affect the stay time [3], the medical treatment system for the shortening of stay time should be changed according to the characteristics of the patients. Most patients with acute back pain will visit the ER. They are mostly need a bed, and if their length of stay is longer, it can become difficult to accommodate new patients at the ER. In this study, we analyzed the factors related to the length of stay time of patients with back pain, who are likely to occupy beds in the ER, and seek to find a way to improve the medical care system that can shorten the stay time of these patients in the future for maintaining the essential function of the ER.

METHODS

Population

Regardless of trauma, this study was conducted with all the back pain patients over 18 years of age who visited the emergency room of a particular our hospital from January 1 to December 31, 2015. We analyzed the medical records retrospectively, patients with other associated injuries, patients with pain due to cancer metastasis, and patients with a medical diagnosis other than musculoskeletal disorders were excluded from the study. The study was conducted after the approval of the St. Vincent's Hospital Institute's Clinical Research Ethics Committee. Because the study was a retrospective analysis of the medical records, consent for each patient was not needed, we didn't used the patient information for any other purposes. Patients were divided into two groups, those with less than 3 hours of stay time, and those with more than 3 hours of stay time. The length of stay time was defined as from the time the patient visited and registered at the ER, their hospital

admission, through to the time the patient was discharged from the hospital or moved to a different hospital. The general characteristics of all subjects were examined, and the two patient groups were examined for general characteristics, injury mechanism, the time of arrival, the sort of imaging test, the type of painkiller used and the time taken for its administration. Comparative analysis was conducted on the final treatment, whether the patient was hospitalized and discharged, whether there was surgery, and the number of consulting departments.

Data collection

Patients' age, gender, channel of visit, injury mechanism, time and day of the week of visit, were studied through the medical records. In addition, we collected the clinical information necessary including the type of painkiller and the timing of its administration, the final diagnosis, the hospitalization and surgery status, and the number of consulting departments.

Statistical analysis

Statistical analysis was performed using SPSS version 18.0 for Windows (SPSS Inc., Chicago, IL, USA). Nominal variables were expressed as counts and percentages of total numbers. Continuous variables were expressed using mean and standard deviation. Chi-square test or Fisher exact test was used for comparison of the two groups. Independent sample *t*-test was used for continuous data and Mann-Whitney *U* test for non-normal distribution. Kruskal Wallis was used for comparison of the three groups, and the statistical significance was judged to be the case when the *p*-value was less than 0.05.

RESULTS

Of the total 746 patients, 274 patients were selected after applying the exclusion criteria. Their general characteristics such as age, sex, visit time, visit method, and injury mechanism were analyzed. Also, we studied the results of imaging tests, treatments, and final decisions after their visit. The subjects were divided into two groups: stay time of less than 3 hours and stay time exceeding 3 hours. The mean age of the two groups was

42.81±14.84 and 57.22±18.37, respectively, showing a meaningful difference, and in particular, the elderly patients showed a high rate in the group exceeding 3 hours. In examining the channel of visit, the number of patients who visited by ambulance in the exceeding group 3 hours was 104 (56.2%), which was significant compared to the number of patients who visited by walking in the less than 3 hours group (64 patients, 72.7%) ($p=0.000$) (Table 1).

In the comparison of the patients' visit time and day of the week, there was a high proportion of 32 patients (36.4%) in the less than 3 hours group that visited the ER between 8 pm and 2 am, in comparison to the group exceeding 3 hours, where the highest proportion of patients visited the hospital between 8 am and 2 pm (69.1%), and the difference was statistically significant ($p=0.009$) (Table 1).

A median of 7 minutes (quartile of 5 to 12.7 minutes) was found in the time taken for the administration of a painkiller in the less than 3 hours group, which was meaningfully fast ($p=0.034$). 86 patients (97.7%) in the

less than 3 hours group only received general imaging tests, while 84 patients (45.2%) in the group exceeding 3 hours underwent additional computed tomography (CT) and magnetic resonance imaging (MRI) testing, showing that the sorts of imaging tests have a meaningful effect on the delay of staying time ($p=0.000$). In the final diagnosis of the patients, it was found that there was a significantly longer stay time in the case of disc herniation.

In the less than 3 hours group, none of the patients consulted with other departments. In the group exceeding 3 hours, 18 patients (9.7%) had more than one department consulting, and this was found to have a significant effect on the stay time ($p=0.010$) (Table 2). In the less than 3 hours group, 78 patients (75.7%) were treated by emergency medicine, 10 by neurosurgery (9.6%) and 1 patient by orthopedic (1.5%), and in the group exceeding 3 hours, 25 patients (13.5%) were treated by emergency medicine, 94 patients (90.4%) by neurosurgery, and 66 (98.5%) by orthopedics. In the case treated by orthopaedic surgeons and neurosurgeons, stay time was increased ($p=0.014$). Although there may be differences in the examination, hospitalization and discharge criteria according to the department, it is noteworthy that only one patient (1.1%) showed a stay time within 3 hours in the orthopedics (Table 2 and Fig. 1).

Table 1. Comparison of the exam and treatment between two groups

	Under the 3 hours (n=88)	Over the 3 hours (n=186)	p-value
Age			0.000
Years	42.81±14.84	57.22±18.37	
Under the 65 years	80 (90.9)	116 (62.4)	
Over the 65 years	8 (9.1)	70 (37.6)	
Man	42 (47.7)	81 (43.5)	0.516
Method of visit			0.000
By walking	64 (72.7)	81 (43.8)	
By ambulance	24 (27.3)	104 (56.2)	
Injury mechanism			0.001
Indirect injury	44 (50.0)	131 (70.4)	
Direct injury	44 (50.0)	55 (29.6)	
Time to visit			0.009
08:00-13:59	16 (18.2)	69 (37.1)	
14:00-19:59	25 (28.4)	48 (25.8)	
20:00-01:59	32 (36.4)	42 (22.6)	
02:00-07:59	15 (17.0)	27 (14.5)	
Weekdays	48 (54.5)	118 (63.4)	0.159

Values are presented as mean±standard deviation or number (%).

DISCUSSION

Back pain is one of the most common symptoms at ER throughout the world. One study reported that the world-wide prevalence of low back pain was 12% [4]. Although our emergency room does not meet the above rates, patients who are visited with back pain account for roughly 4% to 5%. Also most of them generally occupy the beds long-term, contributing to the overcrowding.

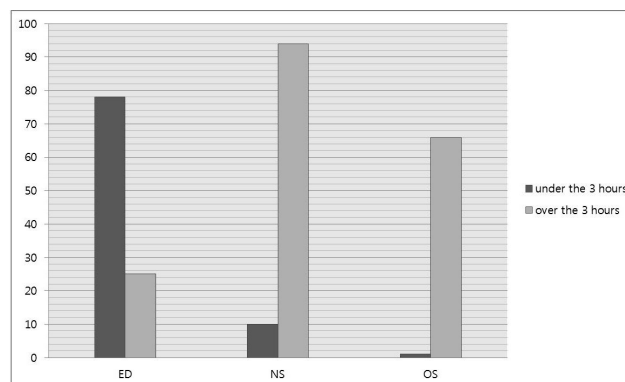
In a study reported in the Canada, patients with back pain were referred to a nearby primary physician after simple pain treatment in the emergency room, regardless of the degree of pain [5]. Although the results of our study did not investigate the degree of pain in patients, but all patients were given analgesic treatment and discharged, or referred to orthopaedic surgeons and neurosurgeons for additional care. It was a somewhat expected result, most

Table 2. Comparison of the exam and treatment between two groups

	Under the 3 hours (n=88)	Over the 3 hours (n=186)	p-value
Pain control			0.000
Tridol	28 (41.8)	76 (44.4)	
Demerol	21 (31.3)	84 (49.1)	
Diclofenac	9 (13.4)	7 (4.1)	
Ketoracin	9 (13.4)	4 (1.7)	
Time to pain control (minutes)	7.0 (5.0-12.7)	10.0 (6.0-16.2)	0.034
Radiologic study			0.000
Only X-ray	86 (97.7)	102 (54.8)	
X-ray, CT	1 (1.1)	13 (7.0)	
X-ray and MRI	1 (1.1)	36 (19.4)	
X-ray, CT, and MRI	0 (0.0)	35 (18.8)	
Diagnosis			0.000
Sprain & strain	60 (68.2)	24 (12.9)	
Compression fx	3 (3.4)	64 (34.4)	
HNP	24 (27.3)	83 (44.6)	
Spinal stenosis	1 (1.1)	15 (8.1)	
Disposition			0.000
Admission	2 (2.3)	59 (41.4)	
Discharge	85 (96.6)	121 (65.1)	
Transfer	1 (1.1)	6 (3.2)	
Operation			0.000
Yes	1 (1.1)	38 (20.4)	
No	87 (98.9)	148 (79.6)	
Consultation			0.010
Yes	0 (0.0)	18 (9.7)	
No	88 (100)	168 (90.3)	
The department of treatment			0.014
ED	77 (87.5)	26 (14.0)	
NS	10 (11.4)	94 (50.5)	
OS	1 (1.1)	66 (35.5)	

Values are presented as median (inter-quartile range) or number (%). CT: computerized tomography, MRI: magnetic resonance image, HNP: herniated nucleus pulposus, ED: emergency department, NS: neurosurgery, OS: orthopedic surgery.

of the patients who were referred to orthopaedic and neurosurgeons showed long stay time. Generally, in our hospital, if there is no improvement within 30 minutes after the pain medication administration, we will refer to orthopedic surgeons or neurosurgery for further evaluation. And, most hospitals do, but orthopedic surgeons or

**Fig. 1.** Comparison of according to the treatment department. ED: emergency department, NS: neurosurgery, OS: orthopedics.

neurosurgery prescribe additional CT or MRI scans. But, because they do not reside in the emergency room, it takes time to prescribe imaging study, if the image shows that the patient does not require surgical treatment, they discharged the patients from the emergency room after the analgesic treatment for long time. Therefore, if the patient does not require hospitalization or surgical treatment after the initial treatment by the emergency medicine department, we should recommend outpatient treatment or transfer of the other hospital without additional referral will be needed to shorten the stay time.

In addition, as shown the our study result, all patients underwent a form of imaging test, and the type of imaging test influenced the stay time. In one study, only 30% of patients underwent imaging tests and most were performed in the elderly patients over 70 years of age, one-third of the patients who were admitted to the hospital reported that the imaging test they received did not have a direct relationship with their symptoms or the necessity of hospitalization, and reported that we should reduce the number of imaging tests in the future [6]. Our study also showed that patients over 65 years of age had a higher proportion in the group exceeding 3 hours, and more imaging tests were performed on them. Although it is thought that in the case of elderly patients, a simple imaging test can be an evaluation process to see whether a lesion has newly developed, but it was difficult to say that it played a major role in determining the treatment direction in the future.

Moreover, Andersen [7] analyzed previously published research and literature and reported that in the case of

back pain patients treated with clinical symptoms without imaging tests, there was no significant difference in short term and long term prognosis compared with the patients with back pain who were treated with imaging tests. In other studies, most of the back pain patients in the emergency room had a good prognosis, and only patients with a high risk symptom (red flag sign), such as a tumor, infection, or neurological abnormalities, needs a CT or MRI, and even in the case of disc herniation, symptomatic treatment showed positive results [8,9]. Although we could not compare the results of our study since we excluded patients with back pain due to medical factors such as tumor invasion or infection, patients who only had simple imaging tests showed significant differences in the less than 3 hours group. In addition, there is no additional abnormality on CT and MRI unless special findings are seen on simple imaging tests in the case of non-traumatic patients. Also, in orthopaedics and neurosurgery, there was no need for hospitalization or surgical treatment other than pain control, and positive prognosis was shown before discharge.

We thought that proper pain control early on was important. Barksdale et al. [10] reported that the nurses of the emergency department were trained in pain classification and applied it to reduce the starting time of pain control for the patients who were visiting because of various pains. In addition, in the study comparing the results of various combinations of painkillers to acute non-traumatic back pain patients, the combination of painkillers and the prognosis of the patient was not related, however, regardless of the degree of pain, the early administration of painkillers helps the patient to control pain quickly, it was reported that even gel-type rub-on painkillers were effective [11,12]. In the our study, painkillers were administered to all back pain patients, and the time required to administer the painkillers was significantly shorter in patients in the less than 3 hours group. The results of the our study showed that a high proportion of non-steroidal anti-inflammatory painkillers were administered in the less than 3 hours group, but because it was likely that the preference of painkillers in each department would have an effect, so it was considered to compare the results after randomization in future analyzes. Based on these results, it is thought that to start

the pain control quickly will ultimately help to reduce the patients' stay time.

In addition, in the case of back pain patients who did not require surgical treatment after simple imaging tests, there were no differentiated treatments other than referral to the neurosurgery or orthopaedic surgery and subsequent CT and MRI. It is important to determine whether the patient is hospitalized or discharged on the basis of the initial simple imaging test, and to determine their transfer to another hospital in the absence of the hospital room. It is also thought it would be most effective if this decision was made by the emergency medical department.

As shown in the results of the study, it was thought that the unnecessary co-consultation with other departments in the emergency room should be avoided, because there was no patient in the less than 3 hours group that received consultation. On the other hand, the stay time of patients who require hospitalization or surgery due to injury or fracture at the time of the research plan were thought to be shorter than non-trauma patients and discharge patients, but in most cases they are not emergency operations, hence their stay time was lengthened. We believe that this problem should be solved at hospital level.

The limitations of this study were that, due to it being a retrospective medical record study, the time for referral to other departments would have been slightly different depending on the physician on the day, and would have affected the results. It is also considered that hospitals have their respective consulting policies or testing guideline, so there is a limit to apply this study to other hospitals. The delay in stay time due to hospitalization delay is not an issue of the ER, but the overall hospital, so we are considering to compare and analysis only discharged patients in further research.

CONCLUSION

In the case of patients visiting the emergency department with back pain, active pain control at the beginning of the visit would help to reduce their length of stay. An unnecessary imaging tests were avoided except in the presence of risk factors, and the emergency physician should ac-

tively intervened to determine early on, whether or not the patient should be hospitalized.

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