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Impaired activity of daily living is a risk factor for high medical cost in patients of non-variceal upper gastrointestinal bleeding

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Abstract

Background Non-variceal upper gastrointestinal bleeding (NVUGIB) is still a common and life-threatening disease, thus it would have a big impact on medical care cost. However, little is known about risk factors for increased medical care cost in NVUGIB patients.

Aim The purpose of the study was to clarify predictor of requiring high medical care cost in NVUGIB patients. Patients who underwent endoscopic hemostasis due to NVUGIB between April 2012 and March 2015 were included in this retrospective study. We analyzed the association between patients' background including activity of daily livings (ADL) and high medical care cost using logistic regression model. Medical care cost was calculated in reference to the "Diagnosis Procedure Combination" which is diagnosis-dominant case-mix system in Japan. The cutoff value of high medical care cost was defined as its first quartile. ADL was assessed according to Katz-6 score. We defined impaired ADL patient who revealed Katz-6 score more than 1.

Results A total of 128 consecutive patients were included in this study. Median medical care cost was 5323 USD (IQR 3661–8172 USD). There were 13 patients (10%) in impaired ADL group. In univariate analysis, age and impaired ADL before admission revealed significant association with high cost. Of these, impaired ADL was an only independent risk factor [odds ratio 15.3 (95% CI 2.49–183)] in multivariate analysis.

Conclusion Impairment in ADL before admission was an independent predictor for high medical care cost with NVUGIB patients.

Keywords Medical care cost · Activity of daily living · ADL · Non-variceal upper gastrointestinal bleeding · NVUGIB · Impaired

As populations age, increasing medical care costs are becoming a major concern, especially in developed countries. Despite the progress of healthcare standards, non-variceal upper gastrointestinal bleeding (NVUGIB) is still a life-threatening disease that sometimes requires intensive care, which has a sustained impact on increasing medical care costs. In fact, medical care costs in Japan have been soaring and were over 340 billion US dollars (USD) in 2014 [1]. Additionally, NVUGIB has maintained a constant rate of medical care cost since the year 2000 [1]. Hence, understanding the risk factors for increased medical care costs in NVUGIB patients would lead to a reduction in medical care costs for these patients. Although there are some reports about medical care costs and clinical therapy, there are a only a small number of reports specifically about the relationship between patients' background and medical care costs in NVUGIB [2–9]. Therefore, we conducted this study to analyze the details of medical care costs in NVUGIB patients as well as to identify risk factors for increased medical care costs.

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Methods

Study design and inclusion criteria

This is a retrospective cohort study from a single tertiary care hospital. The study group comprised consecutive patients who underwent endoscopic hemostasis due to clinical diagnosis of NVUGIB between April 2012 and March 2015. We excluded gastroduodenal ulcer patients with low risk stigmata for rebleeding (Forrest classification IIb, III, and IV) by review of endoscopic images. This study was conducted according to the principles of the Declaration of Helsinki with institutional review board approval.

Management and endoscopic hemostasis for NVUGIB patients

General physicians evaluated the patients' condition based on history, physical examination, and the results of blood examination, etc., and started initial management including crystalloid infusion or blood transfusion. Gastroenterologists decided whether to perform urgent endoscopy. Patients underwent endoscopy under conscious sedation by intravenous midazolam injection, and in case the vital signs were unstable, despite sufficient crystalloid infusion and/or blood transfusion, endoscopy was performed under general anesthesia with tracheal intubation. We generally perform the endoscopic procedure using a high-vision gastroscope with water jet function (GIF-Q260J, Olympus Co, Tokyo, Japan). Endoscopic hemostasis was carried out using hemostatic forceps (Coagrasper®, Olympus Co., Tokyo, Japan), an endoclip (EZClip®, Olympus Co.), or hypertonic saline–epinephrine injection according to each endoscopist's decision. If hemostasis was not obtained endoscopically, interventional radiology (IVR) was conducted. According to guidelines published by the Japan Gastroenterological Endoscopy Society, we generally did not perform second-look endoscopy, except in high-risk cases such as like patients with a high risk of rebleeding. A second-look endoscopy was performed at individual discretion. After successful hemostasis, oral ingestion was resumed from a liquid or semiliquid diet after confirming that rebleeding was not observed. The length of the fasting period and total hospitalization period depended on each physician's decision.

Data collection

We retrospectively collected patient's clinical factors [age, gender, antiplatelet/anticoagulant therapy, Glasgow-Blatchford score on admission, and patients' activities of daily livings (ADL) before admission] from the medical record of each patient. We also collected information about whether endoscopic hemostasis succeeded or failed, as well as fasting period and total hospitalization period as patients' outcomes.

Assessment of medical care costs

Medical care costs were calculated in reference to the "diagnosis procedure combination" reimbursement system in Japan. The currency exchange rate from Japanese yen to USD was presumed to be 120 yen to one USD. We defined increased medical costs as belonging to the highest quartile.

Evaluation of ADL

Information on patients' ADL before admission was collected from medical records. This information was assessed according to the Katz-6 score, which is calculated considering whether the patients were able to perform six basic activities of daily life (bathing, dressing, toileting, sitting, and standing, need for incontinence products and eating) [10]. If patients could not perform these items by themselves, each item was scored 1. Scores of each item were summed, and total scores range from 0 to 6. In this study, we defined poor ADL as a Katz-6 score > 1.

Statistics

The association between increased medical care costs and various factors involved in patients' clinical features and outcomes was analyzed using univariate and multivariate logistic regression models. We performed a multivariate analysis on the factors that revealed a significant association with increased medical care costs in the univariate analysis. We compared fasting period, total hospitalization period and success rate of endoscopic intervention by dividing the study population according to the factors that revealed independence in multivariate analysis using Wilcoxon rank sum test and Student's t test. A p value < 0.05 was considered significant. The analysis was performed using JMP Pro® 11 (SAS Institute Inc., Cary, NC, USA).

Results

Characteristics of eligible patients

The characteristics of the 128 included patients are described in Table 1. The mean age was 70.4 ± 14.7 years old, and approximately two-thirds of the patients were male. The proportion of patients in the poor ADL group was 11%. Twenty-three percent of patients took antiplatelet medicine, and 9% of patients took anticoagulant medicine. Approximately two-thirds of NVUGIB was caused by gastroduodenal ulcer.

Table 1 Characteristics of all patients included in this study

Age[a], years old	70.4 ± 14.7[a]
Gender (male:female)	126:62
Glasgow-Blatchford score (GBS) on admission[b]	14 (5–9)
Katz 6 score before admission[b]	0 (0–6)
Usage of antiplatelet drug	23%
Usage of anticoagulant drug	9%
Etiology of NVUGIB	
Gastroduodenal ulcer	99
Gastric cancer	11
Dieulafoy lesion	9
Mallory–Weiss tear	5
Diffuse antral vascular ectasia	1
Others	3

[a]Data are shown as mean ± SD

[b]Data are shown as median (range)

Table 2 Outcomes of patients

Success rate of endoscopic hemostasis	97.30%
Fasting period (days)[a]	3 (1–41)
Hospitalization period (days)[a]	11 (2–82)

[a]Data are shown as median (range)

Outcomes of patients

Endoscopic hemostasis was achieved by endoscopy in 99.2% of patients in the study group. Two patients who did not achieve endoscopic hemostasis were treated by IVR, and hemostasis was finally obtained. The median fasting period and hospitalization period were 3 days and 11 days, respectively (Table 2).

Medical care cost

The distribution of medical care costs is shown in Fig. 1 and ranged from 1145.3 to 44599.8 USD, and the median was 5323 USD. We found that at the 25th percentile, medical care costs were 8172 USD, and we set this value as the threshold of increased medical care costs. Medical care costs of two patients in whom endoscopic hemostasis failed were 32058.7 USD and 16901.8 USD, respectively, and both of these patients belonged to the increased medical-care cost group.

Risk factors for increased medical care costs

In the univariate analysis, age and poor ADL before admission revealed a significant association with increased medical care costs. Of these, only poor ADL before admission revealed an independent association with increased medical care costs [odds ratio 4.86 (95% CI 1.43–18.2)] in the multivariate analysis (Table 3).

Comparison of outcomes of endoscopic hemostasis between maintained ADL and the poor ADL group

The median fasting period in the poor ADL group was significantly longer than that in the good ADL group (5 vs. 3 days, $p = 0.02$). Additionally, the median hospitalization period in the poor ADL group was significantly longer than that in the good ADL group (22 vs. 10 days, $p = 0.02$) (Table 4). On the other hand, the success rate of

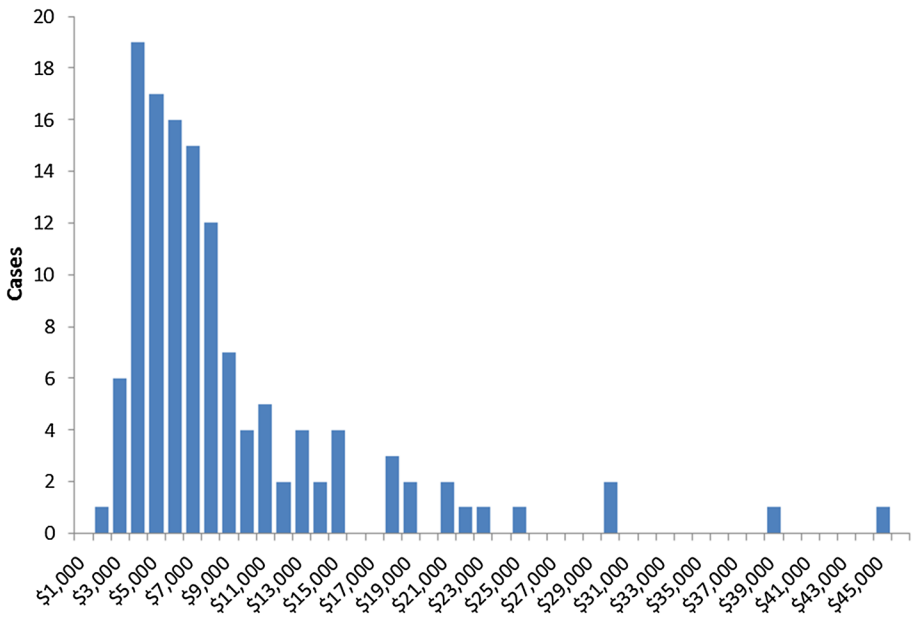

Fig. 1 The histogram of medical care cost in eligible patients

Table 3 Univariate and Multivariate analyses between patients' clinical factors and increased medical care cost

Factors	Univariate analysis		Multivariate analysis	
	OR	[95% CI]	OR	[95% CI]
Age				
Every 10 years	1.51	1.24–2.33	0.76	0.54–1.04
Gender				
Male/female	1.32	0.55–3.10		
Usage of antiplatelet drug				
Yes/no	0.65	0.25–1.68		
Usage of anticoagulant drug				
Yes/no	0.36	0.10–1.27		
GBS				
Every 1	0.89	0.76–1.02		
Katz 6 score				
Poor/good	7.12	2.17–23.3	4.86	1.43–18.2
Result of endoscopic hemostasis				
Failure/success	NS	NS		

the endoscopic intervention did not reveal a significant difference (98.3% vs. 100%) (Table 4).

Discussion

In this retrospective study, we investigated the current status of medical costs in patients with NVUGIB in Japan. Median medical care costs were approximately 5000 USD, and although age was an independent risk factor for increased medical care costs in the univariate analysis, the significance disappeared after adjustment of the ADL level before admission.

Increasing medical care costs are an important issue in aging countries. Annual medical care costs in Japan increased from 125.8 billion USD in 1984 to 345.8 billion USD in 2014, as the proportion of elderly people at least 65 years old increased from 9.8 to 26.0% [1]. The prevalence of NVUGIB has remained almost unchanged since the year 2000, and NVUGIB medical care costs have remained almost 1 billion USD since 2010s [1]. Considering these circumstances, NVUGIB would continue to have a great impact on medical costs, especially in an aging society, because this condition has increased in elderly patients who took low-dose aspirin and anticoagulant drugs [11–13].

There are some studies that analyzed the relationship between NVUGIB medical care costs and clinical practice [2–9]. Bloom and his colleague reported that use of non-steroidal anti-inflammatory drugs (NSAIDs) increases medical care costs; however, afterwards, it was reported that the use of antacid agents limits increasing medical care costs due to NSAIDs [5, 9, 14]. Roy and his colleague reported that failure of endoscopic hemostasis is associated with increased medical costs [2]. Other than these examples, little is known about the association between patients' background and increased medical-care costs in NVUGIB patients.

One of the most important features of this study was that we analyzed the association between medical costs and patients' background factors, including GBS, the content of antiplatelet/coagulant treatment, and ADL before admission, as well as outcomes of endoscopic intervention. We found that NVUGIB medical costs were significantly higher in elderly patients; however, the significance disappeared after adjusting for patients' ADL level. Consistent with our study, impaired ADL was reported to be independently associated with increased medical care costs in patients with chronic obstructive pulmonary disease [15]. The current study showed that medical care costs would also be influenced by ADL even in NVUGIB, which sometimes requires intensive care.

The main cause of the increase in medical costs in the impaired ADL group seemed to be because of the prolonged hospitalization period since there was no difference in the success rate of endoscopic hemostasis or number of endoscopic hemostasis per patient. The total hospitalization period was approximately 10 days longer in impaired ADL patients; on the other hand, the difference of the median fasting period was only 2 days. This result suggests that it took longer for impaired ADL patients to recover after confirmation of hemostasis. It is reported that starting rehabilitation executed on early timing promotes the improvement of ADL during the hospitalization period in COPD patients [16]. And some studies have shown that rehabilitation reduced social cost in patients with Alzheimer's disease [17]. Although it is difficult to distinguish if the prolonged hospitalization period was due to a decline in the ADL level

Table 4 Comparison of outcomes of endoscopic hemostasis between maintained ADL and poor ADL groups

Factors	Maintained ADL group	Poor ADL group	*p* value
Success rate of endoscopic hemostasis	98.3%	100%	NS
Fasting period (days)[a]	3 (1–41)	5 (1–13)	0.02
Hospitalization period (days)[a]	10 (2–82)	22 (5–67)	0.02

[a]Data are shown as median (range)

after admission, which was just the result of each physician's cautious manner in treating patients, we could reduce NVUGIB medical care costs by starting rehabilitation as early as possible after confirmation of hemostasis.

There are some limitations to this study. First, our study was a retrospective study at a single center. The sample size was small because we included only inpatients. Second, the clinical course after admission was not sufficiently considered. We often experience not only an impairment in ADL but also a decline of basal disease, especially in elderly patients in clinical practice. Considering these patients is required to analyze medical care costs.

In conclusion, we found that poor ADL before admission was an independent risk factor for increased medical care costs in NVUGIB patients. Further prospective study is required to confirm our results.

Compliance with ethical standards

Disclosures Dr. Yusaku Takatori, Motohiko Kato, Yukie Sunata, Yuichiro Hirai, Yoko Kubosawa, Keichiro Abe, Yoshiaki Takada, Tetsu Hirata, Shigeo Banno, Michiko Wada, Satoshi Kinoshita, Hideki Mori, Kaoru Takabayashi, Miho Kikuchi, Masahiro Kikuchi, Masayuki Suzuki, and Toshio Uraoka have no conflicts of interest or financial ties to disclosure.

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