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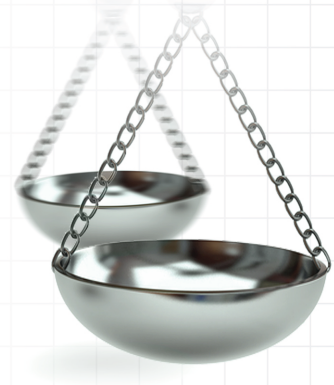

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Does off-hours endoscopic hemostasis affect outcomes of nonvariceal upper gastrointestinal bleeding?

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Aim: Different researches showed controversial results about the 'off-hours effect' in nonvariceal upper gastrointestinal bleeding (NVUGIB). **Materials & methods:** A total of 301 patients with NVUGIB were divided into regular-hours group and off-hours group based on when they received endoscopic hemostasis, and the relationship of the clinical outcomes with off-hours endoscopic hemostasis was evaluated. **Results:** Patients who received off-hours endoscopy were sicker and more likely to experience worse clinical outcomes. Off-hours endoscopic hemostasis was a significant predictor of the composite outcome in higher-risk patients (adjusted OR: 4.63; 95% CI: 1.35–15.90). However, it did not associate with the outcomes in lower-risk patients. **Conclusion:** Off-hours effect may affect outcomes of higher-risk NVUGIB patients receiving endoscopic hemostasis (GBS ≥12).

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Keywords: clinical outcomes • endoscopic hemostasis • Glasgow–Blatchford score • nonvariceal upper gastrointestinal bleeding • off-hours effect

Upper gastrointestinal bleeding (UGIB) is a common medical problem defined as bleeding from the GI tract proximal to the ligament of Treitz [1,2]. The leading causes are peptic ulcer, esophageal varices and malignancy. UGIB is associated with markedly increased mortality and morbidity [3,4]. Despite the improvement in medical healthcare services, UGIB is still a common gastrointestinal emergency. The incidence rate of UGIB is 78 per 100,000 people annually [5], and the fatality rate is approximately 10% [6]. Timely endoscopy plays a central role in the management of UGIB with the value of endoscopic therapy for bleeding from peptic ulcers and esophageal varices being well established [7–10].

To improve the prognosis of patients with UGIB, many hospitals provide endoscopy 24 h a day and 7 days a week, in which patients could receive timely endoscopy at any time of any day. It is reported that those who rebleed after initial hemostasis had a four-times increased risk of death [11], so the success of initial endoscopic hemostasis is important to the prognosis of patients with UGIB. Recently, researchers had a growing interest in the 'off-hours effect', which means the efficiency of work during off-hours is lower than during regular-hours, leading to more adverse events. This issue has raised concern over the treatment quality of very important medical and surgical emergencies, including UGIB. However, the existing reports reached controversial results. Some studies reported increased rates of adverse outcomes [12–16]; whereas, others described that there is no evidence of the existence of the 'off-hours effect' [17,18]. Furthermore, different regions and organizations have different situations and medical environments, the reported results about the 'off-hours effect' may have several discrepancies. There was litter research about the 'off-hours effect' of endoscopy hemostasis in China. Overall, the necessity of further investigation in this area is warranted.

In this retrospective study, we sought to compare clinical outcomes between nonvariceal upper gastrointestinal bleeding (NVUGIB) patients who underwent endoscopic hemostasis during regular-hours versus during off-

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hours and determine whether off-hours effect could influence the outcomes of patients with NVUGIB receiving endoscopic hemostasis.

Materials & methods

Patients

In this study, we used a retrospective study design, which was conducted in the collection in three hospitals of Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, a large tertiary teaching hospital in China. The medical record management system was used to extract medical records of patients conformed to the following standard from 1 January 2016 to 31 January 2020. The inclusion criteria are as follows: patients diagnosed as NVUGIB; received endoscopic hemostasis treatment; after receiving endoscopic hemostasis, patients were hospitalized and managed with conventional therapies, including nil oral intake, intravenous fluids and acid secretion inhibitors. Those patients would be excluded: those who did not cooperate with treatment; those whose medical records were not complete and cannot be analyzed. This research was carried out following the guidelines of the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology.

Data collection

Electronic medical records were employed to obtain the data. Data on baseline characteristics (such as age, sex, history of UGIB), clinical laboratory findings and outcomes of patients were recorded. Patients who received oral anticoagulants, antiplatelet drugs and NSAID were classified as medicine used. Comorbidities were reviewed from medical charts and included diabetes, hypertension, renal failure (creatinine >1.5 mg/dl), end-stage renal disease on dialysis, liver cirrhosis, coronary heart disease, cerebrovascular disease and neoplasms. The primary outcome was the composite outcome which included death, rebleeding after initial endoscopy, need for emergency surgery, angiographic embolization or endoscopic reintervention [19]. Secondary outcomes included length of hospital stay, the need for blood transfusion, volume of blood transfusion, postendoscopy adverse events (aspiration pneumonia, urinary tract infection, sepsis, cerebral infarction, hepatic failure, cardiac failure, renal failure). Rebleeding was defined as bleeding within 1 week that required secondary hemostasis or was associated with hematemesis; melena with an overt decrease in hemoglobin over 2 mg/dl; or endoscopic findings of recent bleeding, such as spurting, oozing or adherent clot [20,21]. Patients who received endoscopic hemostasis during regular-hours (08:00–17:30 on weekdays) were defined as the regular-hours group, and those who received endoscopic hemostasis during off-hours (17:30–8:00 the next day on weekdays or the whole day of weekends/holidays) were classified as off-hours group. The Glasgow–Blatchford Score (GBS) is based on the systolic blood pressure, pulse rate, hemoglobin, serum urea levels, whether the patient presented with melena or syncope and the presence or absence of hepatic disease or cardiac failure. Patients with GBS score of 12 or higher are thought to be at higher risk for further bleeding or death [22]. Patients with GBS<12 were defined as the lower-risk group, and patients with GBS ≥12 were defined as the higher-risk group. The predictors of the composite outcome in both groups were analyzed individually.

Statistical analysis

Data analysis was performed using SPSS 22.0 (IBM, NY, USA). Continuous variables are expressed as mean ± standard deviation, and categorical data are presented as absolute numbers and percent frequencies. Student *t*-test was performed to analyze continuous variables. Chi-square test or Fisher exact test were used for the analysis of categorical variables. A logistic regression model was used to analyze the effect of categorical variables and adjust for potential confounders. The results of logistic regression analyses were summarized by estimating the odds ratio (OR) and respective 95% CI. A two-tailed p-value < 0.05 was considered statistically significant.

Results

Baseline patient characteristics

A total of 301 patients was included in the retrospective study. Of these patients, 204 patients were classified as the regular-hours group, and 97 patients were included in the off-hours group. Parameters including sex, age, smoking, drinking, history of prescribed medicine, comorbidities, history of UGIB, heart rate, hemoglobin and GBS scores were not different between the two groups ($p > 0.05$), while patients in the off-hours group tended to have lower systolic pressure (112.3 ± 21.4 vs 120.7 ± 20.5 mmHg, p = 0.001), lower platelet count (163.8 ± 76.7 vs 185.4 ± 70.1 × 10^9/l, p = 0.016), longer prothrombin time (PT) (16.3 ± 5.2 vs 15.2 ± 2.5s, p = 0.014), higher international normalized ratio (INR) (1.3 ± 0.6 vs 1.2 ± 0.3, p = 0.036), and higher AIMS65 score (1

Table 1. Baseline characteristics of patients receiving endoscopic hemostasis during regular-hours and off-hours.

	Total	Regular-hours	Off-hours	p-value
Number of patients	301	204	97	–
Sex, male	251 (83.4%)	168 (82.4%)	83 (85.6%)	0.484
Age (years)	54.7 ± 14.3	54.5 ± 13.8	55.1 ± 15.2	0.743
Smoking	103 (34.2%)	69 (33.8%)	34 (35.1%)	0.834
Drinking	86 (28.6%)	54 (26.5%)	32 (33.0%)	0.242
History of UGIB	98 (32.6%)	69 (33.8%)	29 (29.9%)	0.497
Medicines	99 (32.9%)	65 (31.9%)	34 (35.1%)	0.582
Comorbidities	145 (48.2%)	95 (46.6%)	50 (51.5%)	0.419
Systolic blood pressure (mmHg)	118.0 ± 21.1	120.7 ± 20.5	112.3 ± 21.4	**0.001**
Heart rate (bpm)	84.3 ± 16.0	83.2 ± 15.3	86.6 ± 17.2	0.081
Hemoglobin (g/l)	82.9 ± 27.4	84.6 ± 27.4	79.1 ± 27.3	0.105
Platelet count (x10^9/l)	178.4 ± 72.9	185.4 ± 70.1	163.8 ± 76.7	**0.016**
Albumin (g/l)	33.0 ± 7.3	34.0 ± 6.9	31.1 ± 7.6	**0.002**
PT (s)	15.6 ± 3.6	15.2 ± 2.5	16.3 ± 5.2	**0.014**
INR	1.3 ± 0.4	1.2 ± 0.3	1.3 ± 0.6	**0.036**
GBS	9.1 ± 3.7	8.8 ± 3.6	9.6 ± 4.0	0.080
AIMS65 score	1 (0, 1)	0 (0, 1)	1 (0, 2)	**0.029**
Etiology				
Peptic ulcers	219 (72.8%)	156 (76.5%)	63 (64.9%)	**0.036**
Mallory–Weiss syndrome	32 (10.6%)	17 (8.3%)	15 (15.5%)	**<0.001**
Vascular malformation	32 (10.6%)	18 (8.8%)	14 (14.4%)	**<0.001**
Esophageal erosions/ulcers	3 (1.0%)	2 (1.0%)	1 (1.0%)	1.000
Diverticular bleeding	2 (0.7%)	2 (1.0%)	0 (0.0%)	1.000
Postoperative bleeding	4 (1.3%)	1 (0.5%)	3 (3.1%)	0.192
Others	9 (3.0%)	8 (3.9%)	1 (1.0%)	0.311
Treatment				
Norepinephrine spraying	96 (31.9%)	64 (31.4%)	32 (33.0%)	0.778
Hemostatic clips	272 (90.4%)	183 (89.7%)	89 (91.8%)	0.574
Epinephrine injection	30 (10.0%)	20 (9.9%)	10 (10.3%)	0.902

$p < 0.05$ was considered statistically significant, and is highlighted in bold.
GBS: Glasgow–Blatchford Score; INR: International normalized ratio; PT: Prothrombin time; UGIB: Upper gastrointestinal bleeding.

[0, 2] versus 0 [0,1], p = 0.029). The etiology of NVUGIB in our study included peptic ulcer, Mallory–Weiss syndrome, vascular malformation, esophageal erosions/ulcers, diverticular bleeding and postoperative bleeding. Among those with NVUGIB, the most common cause was peptic ulcer (72.8%). More patients presented with peptic ulcers in the regular-hours group than off-hours group (76.5 vs 64.9%; p = 0.036). Treatment modalities, including norepinephrine spraying, hemostatic clips, epinephrine injection, were comparable between both groups (all $p < 0.05$) (Table 1).

Treatment outcomes

It is worth noting that the off-hours group had a higher rate of the composite outcome (22.7 vs 9.8%; p = 0.003), a higher rate of recurrent bleeding (17.5 vs 7.8%; p = 0.012), a higher blood transfusion rate (68.0 vs 55.4%; p = 0.037), larger transfusion volume ($p < 0.001$), while the rate of endoscopic reintervention, need for emergency surgery, need for angiographic embolization, the rate of post endoscopy adverse events, mortality and length of hospitalization in two groups were not different significantly (Table 2).

The predictors of the composite outcome

Univariate and multivariate logistic regression analyses were performed to identify the predictors of the composite outcome. For this analysis, the following variables (potential confounders) were included in the model: age, sex, smoking, drinking, history of UGIB, history of prescribed medicine, comorbidities, systolic pressure, heart rate,

Table 2. Outcomes of patients receiving endoscopic hemostasis during regular-hours and off-hours.

	Total (n = 301)	Regular-hours (n = 204)	Off-hours (n = 97)	p-value
The composite outcome	42 (14.0%)	20 (9.8%)	22 (22.7%)	**0.003**
Recurrent bleeding	33 (11.1%)	16 (7.8%)	17 (17.5%)	**0.012**
Endoscopic re-intervention	20 (6.6%)	13 (6.4%)	7 (7.2%)	0.784
Need for emergency surgery	19 (6.3%)	10 (4.9%)	9 (9.3%)	0.145
Angiographic embolization	10 (3.3%)	4 (2.0%)	6 (6.2%)	0.117
Mortality	4 (1.3%)	2 (1.0%)	2 (2.1%)	0.444
Blood transfusion	179 (59.5%)	113 (55.4%)	66 (68.0%)	**0.037**
Transfused blood volume (units), mean (range)	2 (0–5)	2 (0–4)	4 (0–7)	**<0.001**
Postendoscopy adverse events	11 (3.6%)	8 (3.9%)	3 (3.1%)	0.976
Length of hospitalization (days), mean (range)	8 (6–12)	8 (6–12)	9 (7–12)	0.112

$p < 0.05$ was considered statistically significant, and is highlighted in bold.

hemoglobin, platelet count, prothrombin time, INR, GBS scores, AIMS65 scores, etiology, treatment modalities and off-hours endoscopic hemostasis. In univariate analysis, off-hours endoscopic hemostasis was a predictor of increased risk of the composite outcome (OR: 2.70; 95% CI: 1.39–5.23; p = 0.003). After controlling for confounding factors, the result was persistent (OR: 2.29; 95% CI: 1.08–4.81; p = 0.031). On the other hand, the hemoglobin level and AIMS65 scores were independent predictors of the composite outcome (OR: 0.98; 95% CI: 0.96–1.00; p = 0.034; OR: 1.58; 95% CI: 1.07–2.35; p = 0.022) (Table 3).

Lower-risk patients (GBS <12)

Of 216 patients in the lower-risk group, 29 patients (13.4%) reached the primary outcome. In the univariate logistic regression analyses, there were finally six parameters significantly correlated with the composite outcomes, namely hemoglobin (OR 0.96; 95% CI, 0.94–0.98; p < 0.001), albumin (OR 0.87; 95% CI, 0.82–0.93; p < 0.001), PT (OR 1.25; 95% CI, 1.04–1.50; p = 0.017), INR (OR 7.51; 95% CI, 1.17–4.81; p = 0.033), AIMS65 score (OR 2.25; 95% CI, 1.40–3.62; p = 0.001), epinephrine injection (OR 2.87; 95% CI, 1.02–8.06; p = 0.046). Only hemoglobin level was statistically significant after controlling for confounders (OR 0.96; 95% CI, 0.93–0.98; p < 0.001) (Table 4).

Higher-risk patients (GBS ≥12)

There were 85 patients in the higher-risk group, and 26 patients (30.6%) reached the composite outcome. Table 5 showed the results of univariate and multivariate logistic regression analyses on influencing factors of the composite outcome. Although the association of off-hours endoscopic hemostasis with the composite outcomes was reduced with adjustments, off-hours endoscopic hemostasis was still a significant risk factor for the higher-risk group (OR: 4.63; 95% CI: 1.35–15.90; p = 0.015).

Discussion

In the last few years, the 'off-hours effect' has attracted much attention from researchers in medical and health institutions [15–18]. However, the impact of endoscopy hemostasis during off-hours on clinical outcomes remains controversial. In this retrospective cohort study involving 301 patients with NVUGIB who received endoscopic hemostasis at three hospitals, patients who received endoscopic hemostasis during off-hours had an increased risk of reaching the composite outcome including death, rebleeding, need for surgical or interventional radiology intervention or repeated endoscopic intervention. After adjustment for confounding variables especially illness severity, off-hours endoscopic hemostasis was still associated with the composite outcome. In the subgroup analysis, off-hours endoscopic hemostasis was a significant predictor of worse outcomes for higher-risk patients, and this finding persisted after accounting for multiple confounders. However, the off-hours effect was not seen in the lower-risk patients.

The existence of the off-hours effect for NVUGIB is supported by data from some previous studies. Shaheen found that patients admitted to hospital on weekend for peptic ulcer–related hemorrhage had higher mortality in a multicenter, large scale retrospective study [23]. Another study from Europe also showed weekend admission for UGIB was associated with an increased risk of death, or longer lengths of stay [24]. A meta-analysis reported

Table 3. Univariate and multivariate analyses of predictors of the composite outcome.

Predictors	OR (95% CI)	p-value
Univariate analysis		
Sex	0.49 (0.17–1.43)	0.192
Age	1.02 (0.99–1.04)	0.161
Smoking	0.96 (0.48–1.91)	0.896
Drinking	1.00 (0.49–2.06)	1.000
History of UGIB	1.04 (0.52–2.08)	0.908
Medicines	1.16 (0.59–2.29)	0.675
Comorbidities	0.87 (0.45–1.68)	0.682
Systolic blood pressure (mmHg)	0.98 (0.96–0.99)	**0.023**
Heart rate (bpm)	1.01 (0.99–1.03)	0.245
Hemoglobin (g/l)	0.97 (0.95–0.98)	**<0.001**
Platelet count (x10^9/l)	0.99 (0.99–1.00)	**0.013**
Albumin (g/l)	0.90 (0.86–0.95)	**0.000**
PT (s)	1.11 (1.02–1.20)	**0.012**
INR	2.33 (1.13–4.81)	**0.022**
GBS	1.10 (1.01–1.21)	**0.039**
AIMS65 score	2.10 (1.52–2.89)	**0.000**
Peptic ulcers	1.08 (0.52–2.23)	0.835
Mallory–Weiss syndrome	1.16 (0.42–3.21)	0.773
Vascular malformation	1.16 (0.42–3.21)	0.773
Esophageal erosions/ulcers	–	–
Diverticular bleeding	–	–
Postoperative bleeding	2.01 (0.21–20.49)	0.530
Others	0.77 (0.09–6.28)	0.803
Norepinephrine spraying	0.73 (0.35–1.52)	0.208
Hemostatic clips	0.59 (0.22–1.53)	0.394
Epinephrine injection	1.63 (0.62–4.27)	0.276
Off-hours endoscopic hemostasis	2.70 (1.39–5.23)	**0.003**
Multivariate analysis		
Hemoglobin	0.98 (0.96–1.00)	**0.034**
AIMS65 score	1.58 (1.07–2.35)	**0.022**
Off-hours endoscopic hemostasis	2.29 (1.08–4.81)	**0.031**

$p < 0.05$ was considered statistically significant, and is highlighted in bold.
GBS: Glasgow–Blatchford Score; INR: International normalized ratio; PT: Prothrombin time; UGIB: Upper gastrointestinal bleeding.

that weekend admissions were associated with an increased risk of death for UGIB patients [25]. Recent data from Shih and colleagues showed that UGIH patients who were admitted on weekend had higher mortality, particularly in patients with NVUGIH [26]. Similarly, Xia reported that the 'off-hours effect' was associated with increased mortality in NVUGIH patients in a systematic review/meta-analysis [27].

Several studies were not in agreement with the off-hours effect on UGIB patients. Fujita *et al.* showed that there were no significant differences in the clinical outcomes of patients with UGIB admitted during the daytime on weekdays and those admitted at nighttime or weekends [28]. A prospective international multicenter study including 2118 patients found patients presenting off-hours with UGIB do not differ in outcome (blood transfusion, need for surgery, rebleeding, mortality) from those presenting during weekdays [18]. A large retrospective study by Jairath *et al.* also provided similar results, which showed that mortality among patients who received endoscopic hemostasis on weekends was comparable with those on weekdays [29]. There are several possible reasons accounting for why our findings differ. First, we used the composite outcome as our primary outcome, which increased our ability to capture differences of clinical outcomes between the regular-hours group and the off-hours group. In this way, perhaps we could capture the off-hours effect more accurately. Second, patients receiving endoscopic hemostasis during off-hours were always sicker, and the severity was significantly associated with clinical outcomes. According

Table 4. Univariate and multivariate analyses of predictors of the composite outcome in lower-risk patients (Glasgow–Blatchford Score <12).

Predictors	OR (95% CI)	p-value
Univariate analysis		
Sex	0.41 (0.09–1.83)	0.243
Age	1.00 (0.97–1.03)	0.999
Smoking	1.23 (0.53–2.87)	0.631
Drinking	1.57 (0.67–3.69)	0.296
History of UGIB	0.86 (0.34–2.16)	0.747
Medicines	1.15 (0.47–2.80)	0.760
Comorbidities	0.62 (0.26–1.51)	0.295
Systolic blood pressure (mmHg)	0.99 (0.96–1.01)	0.270
Heart rate (bpm)	1.01 (0.98–1.03)	0.539
Hemoglobin (g/l)	0.96 (0.94–0.98)	**<0.001**
Platelet count (x109/l)	0.99 (0.99–1.00)	0.150
Albumin (g/l)	0.87 (0.82–0.93)	**<0.001**
PT (s)	1.25 (1.04–1.50)	**0.017**
INR	7.51 (1.17–4.81)	**0.033**
GBS	1.14 (0.96–1.34)	0.133
AIMS65 score	2.25 (1.40–3.62)	**0.001**
Norepinephrine spraying	0.40 (0.13–1.22)	0.109
Hemostatic clips	0.56 (0.15–2.13)	0.397
Epinephrine injection	2.87 (1.02–8.06)	**0.046**
Off-hours endoscopic hemostasis	1.85 (0.80–4.28)	0.152
Multivariate analysis		
Hemoglobin	0.96 (0.93–0.98)	**<0.001**

$p < 0.05$ was considered statistically significant, and is highlighted in bold.
GBS: Glasgow–Blatchford Score; INR: International normalized ratio; OR: Odds ratio; PT: Prothrombin time; UGIB: Upper gastrointestinal bleeding.

to the Asia-Pacific working group consensus, the GBS could be used to predict clinical outcomes of patients with UGIB [9]. In our study, patients were stratified as higher-risk group and lower-risk group using GBS of 12 as a cut-off to reduce the effect of disease severity [19,22]. Interestingly, the treatment outcomes of lower-risk patients were not associated with off-hours endoscopic hemostasis, while higher-risk patients who received off-hours endoscopy had an increased risk of reaching the composite outcome in our study. This result is in agreement with others [19]. Third, in our hospital, endoscopy treatment was available 24 h per day, 7 days per week. We divided patients into the regular-hours group and off-hours group according to the time of receiving endoscopic hemostasis, which may diminish the impact of the time to endoscopy.

After adjustment for several important confounders including factors associated with disease severity, we still found evidence of the off-hours effect in higher-risk patients. However, we were unable to identify specific factors that accounted for the off-hours effect. Thus, there is still much work to be done. For example, the hemostatic clip was the common treatment modality that requires adequate training and experience. But there was less availability of senior staff especially endoscopists during off-hours, which might lead to a technical challenge with the management of complicated conditions. Novel hemostatic powders, a simple and effective tool in the management of UGIB [30], might help us to further control the off-hours effect. All in all, it is necessary to be more alert and careful regarding endoscopic hemostasis in patients with NVUGIB during off-hours, particularly in higher-risk patients.

However, there were some limitations in our study. First, our study was a retrospective, observational investigation without randomization. There was a risk of patient selection bias and group-selection bias. Second, the number of patients in our study was too small to draw a strong conclusion. In addition, our analyses of clinical outcomes were limited to in-hospital events. Whether the association between off-hours endoscopy and clinical outcomes extends to longer-term outcomes such as 30-day mortality warrants investigation. Hence, we need further research and exploration in the future.

Table 5. Univariate and multivariate analyses of predictors of the composite outcome in higher-risk patients (Glasgow–Blatchford Score ≥12).

Predictors	OR (95% CI)	p-value
Univariate analysis		
Sex	0.56 (0.11–2.76)	0.477
Age	1.05 (1.00–1.10)	**0.040**
Smoking	0.59 (0.17–2.01)	0.397
Drinking	0.35 (0.07–1.68)	0.190
History of UGIB	1.21 (0.40–3.63)	0.734
Medicines	0.95 (0.32–2.85)	0.932
Comorbidities	1.03 (0.32–3.33)	0.961
Systolic blood pressure (mmHg)	0.98 (0.95–1.00)	0.083
Heart rate (bpm)	1.02 (0.99–1.05)	0.304
Hemoglobin (g/L)	0.99 (0.96–1.02)	0.325
Platelet count (x10^9/l)	0.99 (0.98–1.00)	0.052
Albumin (g/l)	0.96 (0.88–1.05)	0.359
PT (s)	1.07 (0.98–1.16)	0.126
INR	1.74 (0.85–3.60)	0.133
GBS	1.03 (0.76–1.41)	0.840
AIMS65 score	2.03 (1.22–3.36)	**0.006**
Norepinephrine spraying	1.29 (0.43–3.87)	0.654
Hemostatic clips	0.73 (0.18–3.05)	0.671
Epinephrine injection	–	–
Off-hours endoscopic hemostasis	5.03 (1.55–16.28)	**0.007**
Multivariate analysis		
AIMS65 score	1.80 (1.05–3.08)	**0.033**
Off-hours endoscopic hemostasis	4.63 (1.35–15.90)	**0.015**

$p < 0.05$ was considered statistically significant, and is highlighted in bold.
GBS: Glasgow–Blatchford Score; INR: International normalized ratio; OR: Odds ratio; PT: Prothrombin time; UGIB: Upper gastrointestinal bleeding.

Conclusion

This retrospective study suggested that NVUGIB patients who received off-hours endoscopic hemostasis might experience worse outcomes compared with those received regular-hours endoscopic hemostasis. Off-hours effect increased the risk of reaching worse outcomes in higher-risk patients; whereas, did not affect the outcomes of lower-risk patients.

Summary points

- Nonvariceal upper gastrointestinal bleeding (NVUGIB) remains a common and important clinical problem.
- Endoscopic hemostasis plays a central role in the treatment of upper gastrointestinal bleeding.
- The presence of the 'off-hours effect' in NVUGIB remains controversial.
- Patients who received off-hours endoscopic hemostasis had an increased risk of reaching the composite outcome including death, rebleeding, need for surgical or interventional radiology intervention or repeated endoscopic intervention.
- After adjustment for several important confounders including factors associated with disease severity, off-hours endoscopic hemostasis was still associated with the composite outcome.
- Off-hours endoscopic hemostasis was a significant predictor of worse outcomes for higher-risk patients (Glasgow–Blatchford Score ≥12).
- Off-hours endoscopic hemostasis did not affect the outcome of lower-risk patients with NVUGIB (Glasgow–Blatchford Score <12).
- It is necessary to be more alert and careful regarding endoscopic hemostasis in patients with NVUGIB during off-hours, particularly in higher-risk patients.

Author contributions

Author J-L Guan, P-Y Li were responsible for study conception and design; author J-L Guan, G Wang, D Fang, Y-Y Han, M-R Wang were responsible for acquisition of data; authors J-L Guan, G Wang were responsible for data analysis; J-L Guan, D-A Tian; P-Y Li were responsible for manuscript editing. All authors have read and approved the submitted version of the manuscript.

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The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

No writing assistance was utilized in the production of this manuscript.

Ethical conduct of research

Our study protocol was approved by the Institutional Ethics Board of Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China (2020S121) and waiver of consent was granted.

Data sharing statement

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

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Papers of special note have been highlighted as: • of interest; •• of considerable interest

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