


The impact of early gastroscopy examination on cardiovascular event-related indices in elderly patients with acute upper gastrointestinal bleeding

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Abstract

Background: To observe the effects of early gastroscopy examination on cardiovascular event-related indicators such as heart rate (HR), blood pressure, and electrocardiogram (ECG) in elderly patients with acute upper gastrointestinal bleeding.

Methods: Sixty patients with upper gastrointestinal bleeding admitted from July 2022 to December 2022 were selected. Patients with relevant contraindications were excluded. All patients underwent early gastroscopy examination. Among them, 30 patients were aged 60 or above (elderly group) and 30 patients were aged below 60 (non-elderly group). Dynamic blood pressure and ECG recordings were obtained before, during, and after gastroscopy examination to assess changes in HR, blood pressure, and ECG.

Results: The HR and blood pressure levels of the elderly group were significantly lower than those of the non-elderly group before, during, and after gastroscopy examination ($P < .05$). In the elderly group, blood pressure and HR were higher during gastroscopy examination compared to before, but lower than during the examination afterward, with statistically significant differences ($P < .05$). The diastolic blood pressure was lower after the examination compared to before, with statistical significance, while the systolic blood pressure was lower, and the HR was higher after the examination, but without statistical significance ($P > .05$). In the non-elderly group, systolic blood pressure and HR were higher during gastroscopy examination compared to before, with statistically significant differences ($P < .05$), while diastolic blood pressure was higher but without statistical significance ($P > .05$). Blood pressure and HR were lower after the examination compared to during, with statistically significant differences ($P < .05$). The occurrence rates of ECG changes were 70% in the elderly group and 30% in the non-elderly group, with a statistically significant difference ($\chi^2 = 5.45$, $P = .02 < .05$).

Conclusion: Early gastroscopy examination in elderly patients with gastrointestinal bleeding did not result in severe cardiovascular adverse events and was relatively safe. However, special attention should be given to the occurrence of cardiac arrhythmias.

Abbreviations: DBP = diastolic blood pressure, ECG = electrocardiogram, HR = heart rate, SBP = systolic blood pressure.

Keywords: upper gastrointestinal bleeding, elderly, electrocardiogram, gastroscopy examination

1. Introduction

Upper gastrointestinal bleeding is a common disease in the fields of gastroenterology and emergency medicine. According to current statistics, the annual incidence rate is approximately 103 cases per 100,000 people, with a mortality rate of about 14% attributed to various underlying causes. Both the incidence and mortality rates of upper gastrointestinal bleeding are positively correlated with age.^[1] The anatomical location of upper gastrointestinal bleeding is defined as involving organs such as the esophagus, stomach, duodenum, gallbladder, and pancreas, situated above the ligament of Treitz. Common causes include

peptic ulcers, esophagogastric varices, gastric malignancies, acute gastric mucosal lesions, and Mallory-Weiss syndrome. Gastroscopy examination in patients with upper gastrointestinal bleeding is not only helpful in identifying the bleeding etiology but also plays a significant role in assessing the disease severity and prognosis. Therefore, numerous international guidelines recommend early emergency endoscopy for stable patients with upper gastrointestinal bleeding, after excluding contraindications.^[2-5]

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Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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With the aging population and the increasing prevalence of cardiovascular and cerebrovascular diseases, elderly patients experiencing gastrointestinal bleeding have become increasingly common in clinical practice. The evaluation and management of patients with acute upper gastrointestinal bleeding require attention not only to the hemodynamic stability after bleeding but also to the patient medical history of cardiovascular diseases and the use of antiplatelet and anticoagulant medications.^[6,7] Compared to the normal aging process, the risk of cardiovascular events is elevated at this time, regardless of whether they have underlying heart disease or not. Under the condition of post-gastrointestinal bleeding, early gastroscopy examination may have a correlation with adverse cardiovascular events. Therefore, we conducted an analysis of elderly patients with upper gastrointestinal bleeding who underwent gastroscopy examination in our hospital, focusing on changes in cardiovascular-related indicators such as heart rate (HR), blood pressure, and electrocardiogram (ECG), aiming to assess the associated risks.

2. Subjects and methods

2.1. Subjects

Patients with upper gastrointestinal bleeding admitted to the General Outpatient Department, Emergency Department, and Inpatient Ward of Qingdao Hospital of Traditional Chinese Medicine, from July 2022 to December 2022 were included in the study. Patients with severe arrhythmias (ventricular fibrillation, frequent premature ventricular contractions), acute myocardial infarction, other contraindications for gastroscopy examination, and confirmed cases of negative gastrointestinal bleeding on emergency endoscopy (leukemia, immune thrombocytopenia, small intestinal tumors, etc) were excluded. A total of 60 cases were included in the study, with the elderly group defined as patients aged ≥ 60 years, with a mean age of 70.40 ± 1.14 years. Among them, there were 18 males (60%) and 12 females (40%), with a hemoglobin level of 82.20 ± 2.56 g/L. The non-elderly group was defined as patients younger than 60 years old, with a mean age of 42.07 ± 1.93 years. Among them, there were 16 males (53%) and 14 females (47%), with a hemoglobin level of 90.33 ± 1.93 g/L.

2.2. Methods

Gastroscopy examination was performed within 24 hours of upper gastrointestinal bleeding. All patients signed informed consent forms for the gastroscopy examination. Local anesthesia was achieved by administering lidocaine gel orally

before the examination. The procedure was performed cautiously, and the bleeding etiology was explored intraoperatively, followed by endoscopic hemostasis based on the patient condition. During the gastroscopy examination, all patients wore dynamic ECG and dynamic blood pressure monitoring devices to record changes in HR, blood pressure, and ECG. Specifically, a 12-lead dynamic ECG blood pressure recorder (Model: CB-2302-A) and an Olympus H260 gastroscopy model were used.

Data analysis was conducted using SPSS 23.0 statistical software. Normally distributed continuous data were presented as mean \pm standard deviation (mean \pm SD). Independent sample *t* tests were used for comparisons between the 2 groups of continuous variables, while paired *t* tests were used for comparisons before, during, and after the examination. Chi-square tests were used for comparisons of rates. A significance level of $P < .05$ was considered statistically significant.

2.3. Results

2.3.1. The effect of early gastroscopy examination on HR in patients with upper gastrointestinal bleeding. In the elderly group, the HR of patients with upper gastrointestinal bleeding was lower before, during, and after the gastroscopy examination compared to the non-elderly group, with statistically significant differences ($P = .015$; $P = .001$; $P = .003$, $P < .05$) (Fig. 1).

2.3.2. The effect of early gastroscopy examination on blood pressure in patients with upper gastrointestinal bleeding. In the elderly group, patients with upper gastrointestinal bleeding had lower blood pressure (systolic/diastolic) levels before, during, and after the gastroscopy examination compared to the non-elderly group, with statistically significant differences ($P = .02$; $P = .005$; $P = .012$; $P = .015$; $P = .003$; $P = .002$, $P < .05$) (Fig. 2).

2.3.3. Analysis of changes in blood pressure and HR in patients with upper gastrointestinal bleeding before and after early gastroscopy examination. In the elderly group, patients with upper gastrointestinal bleeding showed significantly higher systolic blood pressure (SBP), diastolic blood pressure (DBP), and HR during the gastroscopy examination compared to before ($P < .05$).

In the non-elderly group, patients with upper gastrointestinal bleeding exhibited significantly higher SBP and HR during the gastroscopy examination compared to before ($P < .05$). The DBP was higher but without statistical significance ($P = .075 > 0.05$) (Fig. 3).

	Number	Before the gastroscopy examination HR (r/min)	During the gastroscopy examination HR (r/min)	After the gastroscopy examination HR (r/min)
Elderly group	30	73.30 \pm 2.12	80.77 \pm 2.24	74.47 \pm 2.01
Non-elderly group	30	79.90 \pm 1.56	91.17 \pm 2.17	82.40 \pm 1.55
T value		-2.505	-3.334	-3.059
P value		0.015	0.001	0.003

HR:Heart Rate

Figure 1. Heart rate changes in patients with upper gastrointestinal bleeding undergoing early gastroscopy examination.

	Number	Before the gastroscopy examination SBP (mmHg)	Before the gastroscopy examination DBP (mmHg)	During the gastroscopy examination SBP (mmHg)	During the gastroscopy examination DBP (mmHg)	After the gastroscopy examination SBP (mmHg)	After the gastroscopy examination DBP (mmHg)
Elderly group	30	108.17±2.21	71.63±1.51	112.43±2.47	73.93±1.74	106.83±2.11	69.47±1.53
Non-elderly group	30	115.23±1.96	77.00±1.07	121.00±2.19	78.93±0.93	115.60±1.95	75.67±1.13
T value		-2.392	-2.892	-2.596	-2.529	-3.046	-3.258
P value		0.02	0.005	0.012	0.015	0.003	0.002

SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure

Figure 2. Blood pressure changes in patients with upper gastrointestinal bleeding undergoing early gastroscopy examination.

	Elderly group			Non-elderly group		
	SBP	DBP	HR	SBP	DBP	HR
	(mmHg)	(mmHg)	(r/min)	(mmHg)	(mmHg)	(r/min)
Before the gastroscopy examination	108.17±2.21	71.63±1.51	73.30±2.12	115.23±1.96	77.00±1.07	79.90±1.56
During the gastroscopy examination	112.43±2.47	73.93±1.74	80.77±2.24	121.00±2.19	78.93±0.93	91.17±2.17
T value	-4.455	-4.133	-5.894	-5.556	-1.846	-5.554
P value	0.000	0.000	0.000	0.000	0.075	0.000

SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure HR:Heart Rate

Figure 3. Blood pressure and heart rate changes in patients with upper gastrointestinal bleeding before and during early gastroscopy examination.

In both the elderly and non-elderly groups, patients with upper gastrointestinal bleeding showed statistically significant decreases in SBP, DBP, and HR after the gastroscopy examination compared to during the examination ($P < .05$) (Fig. 4).

In the elderly group, patients with upper gastrointestinal bleeding showed a statistically significant decrease in DBP after the gastroscopy examination compared to before ($P < .05$). However, there was no statistically significant difference in SBP ($P = .131 > 0.05$). The HR after the examination was not significantly different from before ($P = .286 > .05$).

In the non-elderly group, there were no statistically significant differences in systolic and DBP after the gastroscopy examination compared to before ($P > .05$). However, the HR after the examination was significantly higher than before ($P < .05$) (Fig. 5).

2.3.4. Effects of early gastroscopy examination on ECG in patients with upper gastrointestinal bleeding. Gastroscopy

examination reveals various changes in the ECG, including sinus tachycardia, sinus bradycardia, conduction block (I-II°), premature atrial contractions, atrial fibrillation, premature ventricular contractions, ST segment depression, and prolonged QT interval. The occurrence rates of these ECG changes were 70% in the elderly group and 30% in the non-elderly group, demonstrating a statistically significant difference ($\chi^2 = 5.45, P = .02 < .05$) (Fig. 6).

3. Discussion

Following upper gastrointestinal bleeding, there is a decrease in effective circulating blood volume, leading to inadequate coronary perfusion and reduced myocardial oxygenation. This triggers compensatory tachycardia, increasing the myocardial workload. Additionally, sympathetic nervous system activation, stimulation of vasoconstrictors such as angiotensin and catecholamines, cause coronary constriction, enhance myocardial contractility, and increase myocardial oxygen consumption,

	Elderly group			Non-elderly group		
	SBP	DBP	HR	SBP	DBP	HR
	(mmHg)	(mmHg)	(r/min)	(mmHg)	(mmHg)	(r/min)
During the gastroscopy examination	112.43±2.47	73.93±1.74	80.77±2.24	121.00±2.19	78.93±0.93	91.17±2.17
After the gastroscopy examination	106.83±2.11	69.47±1.53	74.47±2.01	115.60±1.95	75.67±1.13	82.40±1.55
T value	5.925	5.590	4.945	5.170	3.263	5.949
P value	0.000	0.000	0.000	0.000	0.003	0.000

SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure HR:Heart Rate

Figure 4. Blood pressure and heart rate changes in patients with upper gastrointestinal bleeding during and after early gastroscopy examination.

	Elderly group			Non-elderly group		
	SBP	DBP	HR	SBP	DBP	HR
	(mmHg)	(mmHg)	(r/min)	(mmHg)	(mmHg)	(r/min)
Before the gastroscopy examination	108.17±2.2	71.63±1.51	73.30±2.1	115.23±1.96	77.00±1.07	79.90±1.5
	1		2			6
After the gastroscopy examination	106.83±2.11	69.47±1.53	74.47±2.0	115.60±1.95	75.67±1.13	82.40±1.5
			1			5
T value	1.556	3.640	-1.087	-0.492	1.348	17.076
P value	0.131	0.001	0.286	0.626	0.188	0.000

SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure HR:Heart Rate

Figure 5. Blood pressure and heart rate changes in patients with upper gastrointestinal bleeding before and after early gastroscopy examination.

resulting in myocardial injury. In severe cases, myocardial infarction, malignant arrhythmias, and even death can occur. The incidence of coronary heart disease, arrhythmias, and metabolic syndrome, such as hyperlipidemia, is significantly higher in the elderly population compared to younger individuals. Age-related degenerative changes in vital organs like the heart, brain, and kidneys, along with atherosclerosis, decrease the compensatory capacity for low blood volume following bleeding.^[8] Additionally, the use of antiplatelet and anticoagulant drugs for the prevention and treatment of the aforementioned conditions can not only damage the gastric mucosa, which is one of the causes of upper gastrointestinal bleeding but also affect the activation of the coagulation system following bleeding. Clinical observations show that patients undergoing gastroscopy examination often experience stress reactions. Some reports have indicated that gastroscopy examination activates the sympathetic nervous system, reduces vagal tone, and can induce arrhythmias and myocardial ischemia.^[9] Therefore, the safety assessment of cardiovascular adverse events is of great importance when

performing gastroscopy examination in elderly patients in the post-acute upper gastrointestinal bleeding state.

This study demonstrated that patients with acute upper gastrointestinal bleeding exhibited a transient trend of increased blood pressure and accelerated HR during the gastroscopy examination, with statistically significant differences observed in all parameters except for DBP in the non-elderly group. However, after the completion of the gastroscopy examination, the blood pressure gradually returned to the pre-examination level, which is consistent with previous healthy older subject under gastroscopy.^[10] Particularly noteworthy is the finding of an increased HR after gastroscopy compared to before the examination, which may be related to compensatory mechanisms due to anemia and autonomic nervous system imbalance. The study revealed that elderly patients with upper gastrointestinal bleeding had lower blood pressure and HR levels before, during, and after gastroscopy compared to the non-elderly group. The underlying reasons for this observation may include age-related decline in organ reserve function,

	Number	Sinus tachycardi	Sinus bradycardia	Conduction blocks (I-II)	A P B	A F	V P B	V T	V F	ST- segment depression	Prolonged QT intervals	Total
Elderly group	30	3	1	2	3	1	2	0	0	5	4	21 (70%)
Non- elderly group	30	5	0	1	1	1	0	0	0	2	2	12 (40%)

APB: Atrial Premature Beats AF: Atrial Fibrillation VPB: Ventricular Premature Beats
VT: Ventricular Tachycardia VF: Ventricular Fibrillation

Figure 6. ECG changes in patients with upper gastrointestinal bleeding undergoing early gastroscopy examination. ECG = electrocardiogram.

higher prevalence of concurrent cardiovascular and cerebrovascular diseases, and late presentation of chronic bleeding due to tumor-related causes, resulting in chronic blood loss, nutritional depletion, and delayed medical consultation. This interpretation is supported by the differences in blood pressure, HR, and hemoglobin levels between the elderly group and the control group before the examination. The analysis of ECGs in both groups showed the presence of sinus tachycardia, sinus bradycardia, conduction blocks, premature contractions, atrial fibrillation, prolonged QT intervals, and ST segment depression during the gastroscopy procedure, while malignant arrhythmias such as ventricular tachycardia, ventricular flutter, and ventricular fibrillation were not observed. It is worth noting that the occurrence rate of cardiac arrhythmias was higher in the elderly group than in the non-elderly group, which may be attributed to age-related decline in cardiac function, atherosclerosis, increased bleeding volume, and abnormalities in cardiac pacemakers.

The limitations of this study include the prerequisite for excluding patients with hemodynamic instability, acute myocardial infarction, malignant arrhythmias, and other contraindications before performing gastroscopy for acute upper gastrointestinal bleeding. The inclusion of patients with a history of serious cardiovascular events was also filtered in advance, reducing the diversity of conclusions. For example, previous studies have reported a prevalence of prolonged QT interval of approximately 30% to 50% in patients with liver cirrhosis-induced upper gastrointestinal bleeding,^[11] and also approximate 30.35% right bundle branch block in the subject of upper gastrointestinal bleeding,^[12] while this study showed an overall prevalence of prolonged QT interval and bundle branch block of about 10% and 5% respectively. The inconsistency in conclusions may be related to the smaller sample size in this study. Furthermore, considering the critical nature of the disease and its acute and severe characteristics, it is challenging to track comprehensive cardiovascular event evaluation indicators such as complete myocardial enzymes and cardiac ultrasound.

In conclusion, for elderly patients with acute upper gastrointestinal bleeding, the anticipation of cardiovascular adverse events during emergency endoscopy is crucial. This aspect serves as an evaluation of the risk associated with endoscopy and ensures the safeguarding of diagnostic and therapeutic benefits for the patients. Through the analysis of data such as HR, blood pressure, and ECGs, we have found that, except for severe contraindications related to heart conditions, there were no occurrences of serious cardiovascular adverse events in the elderly population with upper gastrointestinal bleeding after undergoing gastroscopy. This suggests a relative safety profile, but it is essential to be particularly attentive and vigilant to the potential onset of malignant arrhythmias.

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This study was approved by the ethics committee of Qingdao Hospital of Traditional Chinese Medicine.

Author contributions

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