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Application of Bedside Ultrasound-Guided Anesthesia Management in Emergency Elderly Patients with Intestinal Obstruction

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Abstract: *Objective:* To investigate the application effect of bedside ultrasound-guided anesthesia management in elderly patients with emergency intestinal obstruction undergoing surgery, and to provide a reference for optimizing perioperative anesthesia management for such patients in primary-level hospitals. *Methods:* A total of 107 elderly patients with emergency intestinal obstruction who underwent surgery under general anesthesia in our hospital between June 2024 and March 2026 were prospectively enrolled. Forty-nine patients in the control group received anesthesia management based on routine vital-sign monitoring combined with clinical experience. On the basis of conventional management, 58 patients in the study group underwent bedside transthoracic ultrasound assessment of respiratory variation in inferior vena cava diameter, left ventricular volume and systolic function, and pulmonary edema and atelectasis; the ultrasound findings were used to guide anesthesia induction, volume supplementation, and vasoactive drug administration. The incidence of intraoperative cardiovascular adverse events, postoperative ICU admission rate, length of ICU stay, total length of hospital stay, and 24-hour postoperative mortality were compared between the two groups. *Results:* The incidence of intraoperative cardiovascular adverse events was lower in the study group than in the control group (62.07% vs 83.67%, $\chi^2 = 6.144$, $P = 0.013$). There were no statistically significant differences in the postoperative ICU admission rate or 24-hour postoperative mortality between the two groups ($P > 0.05$). The length of ICU stay [(2.0 ± 1.0) d] and total length of hospital stay [11.0 (9.0, 16.0) d] in the study group were shorter than those in the control group [(2.6 ± 1.3) d and 13.0 (10.0, 17.0) d, respectively], and the differences were statistically significant ($P < 0.05$). *Conclusion:* Bedside ultrasound-guided anesthesia management can reduce the risk of intraoperative cardiovascular adverse events and shorten the length of ICU stay and total length of hospital stay in elderly patients with emergency intestinal obstruction. It is helpful for improving postoperative recovery and has clinical application value for enhancing surgical anesthesia safety for such patients in primary-level hospitals.

Keywords: Bedside ultrasound; Elderly; Intestinal obstruction; Anesthesia management; Perioperative cardiovascular adverse events

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1. Introduction

Elderly patients with intestinal obstruction represent a relatively common patient group in primary hospitals. They often present to the emergency department with incomplete preoperative examinations and generally have an effective circulating volume deficit before surgery. In cases of strangulated intestinal obstruction, additional problems such as toxin absorption and systemic inflammatory response may occur. Moreover, many of these patients have underlying cardiovascular diseases, making anesthesia and surgery extremely high-risk. Any improper management can readily induce various cardiovascular adverse events and may even lead to death [1]. In primary hospitals, anesthesiologists often manage such patients based on routine vital sign monitoring indicators combined with their own clinical experience, which is somewhat arbitrary and has deficiencies in anesthesia risk control. Studies have shown that anesthesiologists trained in transthoracic ultrasound can effectively prevent and manage perioperative cardiovascular adverse events in surgical patients by assessing inferior vena cava respiratory variability, left ventricular systolic function, and signs of pulmonary edema at the bedside, thereby optimizing anesthesia management and improving patient outcomes [2-5]. However, whether this measure is equally effective in emergency elderly patients with intestinal obstruction in primary hospitals remains to be further verified. This study compared the effects of bedside ultrasound-guided anesthesia management and conventional anesthesia management on perioperative cardiovascular adverse events and postoperative outcomes in emergency elderly patients with intestinal obstruction, aiming to provide a reference for improving anesthesia management in such patients in primary hospitals.

2. Materials and methods

2.1. General data

Prospectively enrolled were emergency elderly patients with intestinal obstruction who underwent surgery in our hospital from June 2024 to March 2026, totaling 107 cases. Inclusion criteria: (1) emergency patients with intestinal obstruction scheduled for general anesthesia; (2) age ≥ 65 years; (3) American Society of Anesthesiologists (ASA) classification I–III; (4) complete clinical data. Exclusion criteria: hepatic or renal insufficiency, heart failure, shock, severe arrhythmia, coagulation dysfunction, intraoperative massive hemorrhage, and refusal to participate. Patients whose induction and maintenance of general anesthesia were regulated based on clinical experience were assigned to the control group (49 cases), and those whose anesthesia was regulated based on bedside ultrasound findings were assigned to the study group (58 cases). Control group: male 27 cases, female 22 cases; age 65–87 years. Study group: male 37 cases, female 21 cases; age 65–91 years. Comparison of general data between the two groups showed no statistically significant differences ($P > 0.05$), indicating comparability.

2.2. Anesthesia methods

2.2.1. Control group

Anesthesia management during induction and maintenance of general anesthesia based on clinical experience. Before surgery, invasive arterial and central venous access was established, and active warming measures were implemented. Conventional sedatives, analgesics, and muscle relaxants were administered for anesthesia induction. After endotracheal intubation, a lung-protective mechanical ventilation strategy was applied. Intraoperative maintenance was achieved with continuous intravenous combined with inhalational

anesthesia. Routine monitoring included intraoperative vital signs (non-invasive/invasive blood pressure, central venous pressure, heart rate, oxygen saturation, depth of anesthesia, body temperature, etc.) and intermittent blood gas analysis. Intraoperative anesthesia management was adjusted according to changes in vital signs and blood gas analysis results. After surgery, nerve block combined with intravenous analgesia was routinely performed. Postoperatively, the anesthesiologist decided whether the patient returned to the ward or the ICU based on the patient's condition.

2.2.2. Study group

Anesthesia management during induction and maintenance of general anesthesia based on bedside ultrasound findings. In addition to the control group protocol, transthoracic ultrasound monitoring equipment was used to guide anesthesia induction and intraoperative maintenance. Before anesthesia induction, volume status was assessed based on inferior vena cava ultrasound evaluation and left ventricular volume status; cardiac structure and function were evaluated based on myocardial activity and Doppler flow findings; and atelectasis or edema was assessed by lung ultrasound. Targeted anesthesia adjustments were made according to the assessment results. For patients with volume deficiency and increased inferior vena cava respiratory variability, the rate of anesthetic administration was appropriately slowed, the dose of propofol was reduced, and small-dose preloading was performed in advance to avoid severe intraoperative hypotension. For patients with weak cardiac function and reduced left ventricular systolic function, an anesthesia induction regimen with less myocardial depression was adopted. During surgery, intermittent cardiopulmonary ultrasound assessments were performed, and anesthesia depth, fluid infusion rate, and vasoactive drug dosage were adjusted in real time based on dynamic ultrasound results combined with vital signs and blood gas analysis. At the end of surgery, management was consistent with that of the control group.

2.3. Observation indicators

The incidence of intraoperative cardiovascular adverse events, postoperative destination (ICU or general ward), ICU length of stay, hospital length of stay, and in-hospital mortality were compared between the two groups. Cardiovascular adverse events were defined as composite cardiovascular events, including hypertension > 180/100 mmHg, hypotension < 80/50 mmHg, HR > 110 beats/min, HR < 50 beats/min, new-onset arrhythmia, acute heart failure, myocardial infarction, myocardial injury, conduction block, cerebrovascular accident, and cardiac death.

2.4. Statistical analysis

Statistical analysis was performed using SPSS 26.0 software. Measurement data conforming to a normal distribution were expressed as mean ± standard deviation (SD), and independent-samples t-tests were used for between-group comparisons. Categorical data were expressed as [n (%)] and compared using the χ^2 test. A P value < 0.05 was considered statistically significant.

3. Results

3.1. Preoperative general conditions of patients

As shown in **Table 1**, all P values for comparisons of general data between the two groups were > 0.05, indicating that the baseline data were comparable between the groups.

Table 1. Comparison of preoperative general data between the two groups [n (%), mean ± SD]

Item	Control group (n=49)	Study group (n=58)	Statistic	P value
Sex [n (%)]			$\chi^2 = 0.835$	0.361
Male	27 (55. 10)	37 (63. 79)		
Female	22 (44. 90)	21 (36. 21)		
Age (years)	74.26 ± 6.15	75.03 ± 6.82	t = 0.612	0.542

3.2. Comparison of the incidence of intraoperative cardiovascular adverse events between the two groups

As shown in **Table 2**, the incidence of intraoperative cardiovascular adverse events was lower in the study group than in the control group ($P < 0.05$).

Table 2. Comparison of intraoperative cardiovascular adverse event incidence between the two groups [n (%)]

Group (n)	Cardiovascular adverse events (n, %)	No adverse events (n, %)
Control group (n=49)	41 (83.67)	8 (16.33)
Study group (n=58)	36 (62.07)	22 (37.93)
χ^2	6.144	
P	0.013	

3.3. Comparison of postoperative disposition between the two groups

As shown in **Table 3**, no significant difference was found in postoperative disposition between the two groups ($P > 0.05$).

Table 3. Comparison of postoperative disposition between the two groups [n (%)]

Group (n)	General ward (n, %)	ICU (n, %)
Control group (n=49)	31 (63.27)	18 (36.73)
Study group (n=58)	37 (63.79)	21 (36.21)
χ^2	0.003	
P	0.955	

3.4. Comparison of ICU length of stay and total hospitalization duration

As shown in **Table 4**, the ICU length of stay and total hospitalization duration in the study group were shorter than those in the control group, and the differences were statistically significant ($P < 0.05$).

Table 4. Comparison of ICU length of stay

Group	ICU length of stay (d)	Total hospitalization days [M (P25, P75)]
Control group (n=48)	2.6 ± 1.3	13.0 (10.0, 17.0)
Study group (n=57)	2.0 ± 1.0	11.0 (9.0, 16.0)
t/Z	2.612	1.969
P	0.010	0.049

3.5. Comparison of the incidence of 24-hour postoperative mortality

As shown in **Table 5**, one patient died within 24 hours in each of the study group and the control group, and

the difference was not statistically significant ($P > 0.05$).

Table 5. Comparison of the incidence of 24-hour postoperative mortality

Group (n)	Death (n, %)	Non-death (n, %)
Control group (n=49)	1 (2.04)	48 (97.96)
Study group (n=58)	1 (1.72)	57 (98.28)
χ^2	0.018	
P	0.894	

4. Analysis and discussion

Elderly emergency patients with intestinal obstruction often present with pathophysiological disturbances and frequently have comorbid cardiovascular, cerebrovascular, and pulmonary diseases, resulting in reduced physiological reserve and a high risk of intraoperative complications, especially cardiovascular complications. Conventional anesthesia management, which relies on routine vital signs and clinical experience, is inadequate for preventing and controlling the risk of intraoperative cardiovascular adverse events. Therefore, it is necessary to optimize the intraoperative anesthesia management strategy.

In the cases reported here, the incidence of intraoperative cardiovascular adverse events in the study group was lower than that in the control group. This was mainly attributed to the anesthesiologist's use of preoperative and intraoperative bedside ultrasound assessment to understand the patient's volume status and cardiac status, and to proactively manage key steps such as anesthesia induction, endotracheal intubation, and intraoperative abdominal decompression—for example, by administering fluids in advance and appropriately using vasoactive agents and inotropic drugs. This strengthened and refined anesthesia management, naturally reducing the probability of cardiovascular adverse events compared with the traditional experience-based anesthesia management in the control group. Regarding patient disposition, compared with the control group, the study group did not reduce the proportion of patients transferred to the ICU. This may be related to the small sample size, and also because if such patients were directly returned to the general ward, inadequate medical and nursing care in the ward could pose medical risks. Based on this consideration, transferring to the ICU becomes a preferential choice for anesthesiologists. In fact, some of these patients might be more suitable for transition to an Anesthesia Intensive Care Unit (AICU), which is a safer and more economical option [6]. In terms of ICU length of stay, the study group had a shorter ICU stay than the control group, demonstrating that precise anesthesia regulation and management guided by bedside ultrasound can better stabilize the patient's internal environment, control stress responses, and promote faster recovery. The ICU serves merely as a transition and auxiliary supportive treatment, similar to the role of the AICU, which is consistent with the enhanced recovery after surgery (ERAS) strategies advocated in recent years [7]. The same result was reflected in the total length of hospital stay: compared with the control group, the study group had a shorter total hospital stay. The reason is that, given the comparable baseline characteristics of the two groups, anesthesia management, surgical outcomes, and postoperative nursing played crucial roles. Fewer adverse events, shorter ICU stays, and faster recovery inevitably lead to shorter total hospital stays. In primary hospitals where surgeons' techniques and nursing concepts are relatively fixed, refined anesthesia management further highlights its importance [8]. Due to practical work constraints, we only recorded 24-hour postoperative mortality, and the difference between the two groups was not statistically significant. The

reason may be that such patients have severe symptoms, and their treatment may require multidisciplinary team collaboration, with refined anesthesia management being only one component [9]. In addition, the small sample size is also an important reason.

This study is only our preliminary exploration and has some obvious limitations: (1) We did not conduct strict randomized controlled grouping but only observed and managed patients according to actual clinical situations. (2) The sample size is too small; a larger sample and multicenter observation are needed. (3) We only conducted preliminary patient endpoint observations; future studies should incorporate more health economics indicators and long-term observational follow-up [10].

5. Conclusion

For elderly emergency patients with intestinal obstruction, bedside ultrasound-guided anesthesia management can effectively reduce the incidence of intraoperative cardiovascular adverse events, decrease postoperative ICU stay, and shorten hospital stay. It holds significant value for improving surgical safety and is worthy of promotion in primary hospitals.

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Disclosure statement

The author declares no conflict of interest.

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